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ABSTRACT

This third paper in a set on computer usage in mathematics education provides an annotated listing of selected books, articles, and other documents on computers. Entries are organized by topics: the general educational role of computers; computer languages and programming; and mathematics instruction applications, including teaching about computers, general uses in mathematics classes, tutorial and practice modes, and problem-solving mode. For other documents in this series, see SE 016 289 through SE 016 292. (Author/DT)

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THE USE OF COMPUTERS IN MATHEMATICS EDUCATION
RESOURCE SERIES

# III. THE USE OF COMPUTERS IN MATHEMATICS EDUCATION: BIBLIOGRAPHY

Part 1. General Educational Role

Part 2. Languages and Programming

Part 3. Mathematics Instruction Applications

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February 1973

THE USE OF COMPUTERS IN MATHEMATICS EDUCATION:

RESOURCE SERIES

This is a set of papers and bibliographies addressed to both mathematics teachers and mathematics educators. An introductory paper discusses the general role of the computer in education. A second paper considers the use of computers in what is at present their most widely-used role, as a tool in mathematics problem-solving. A third paper reviews research related to computer uses in mathematics education. A three-part bibliography includes selected references on the general role of computers, on language and programming, and on mathematics instructional applications.

The titles in this resource series are:

The Use of Computers in Mathematics Education:
I. COMPUTER INNOVATIONS IN EDUCATION by Andrew R. Molnar

The Use of Computers in Mathematics Education:
II. COMPUTER-EXTENDED PROBLEM SOLVING AND ENQUIRY by Larry L. Hatfield

The Use of Computers in Mathematics Education:
III. BIBLIOGRAPHY
Part 1. General Educational Role
Part 2. Languages and Programming
Part 3. Mathematics Instruction Applications
A. Teaching About Computers
B. General Uses
C. Tutorial and Practice Modes
D. Problem-Solving Mode

The Use of Computers in Mathematics Education:
IV. RESEARCH ON COMPUTERS IN MATHEMATICS EDUCATION by Thomas E. Kieren

The ERIC Information Analysis Center for Science, Mathematics and Environmental Education is pleased to make these papers and bibliography available.

Jon L. Higgins
Associate Director for
Mathematics Education

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## Editorial Comment

Two things must be noted about this three-part bibliography:

(1) This is a selected list of references. Thus, there is no claim that the listing is complete, or that all materials on computers were perused as this listing was compiled. The criteria for selection are not precise, but an attempt was made to select references which those teaching about and using computers would find helpful. A continuum of backgrounds is spanned, from references requiring no previous knowledge of computers to references for those with much experience, for elementary through college levels. Hopefully, the annotations, in combination with the titles, will help the user to ascertain the appropriateness of the reference for his purpose.

(2) Each citation is included under only one category. Obviously, many citations would have been appropriate in more than one category. The user may find that it is helpful to scan each of the categories to be certain that a reference in which he might be interested is not missed.

Lists of references in which an attempt is made to select and categorize are inevitably subject to problems and questions. The compiler reaches points of despair, where he wants to throw up his hands and say, "I'll put them all in one long list!" The user reaches points of frustration, too, where he says, "That obviously doesn't belong in this category!" The categorization is intended to save the user time, a pre-selection process so that the user doesn't have to search through hundreds of references to find the ones he wants to pursue further. Hopefully, it gives the user a more compact and manageable list of those references which are most appropriate to his interests and need for information.

Many of the computer manufacturers and computer systems firms have published manuals or guides to the languages and computers which they make or use. Often these contain specific mathematical applications. Some firms also provide informative pamphlets. It is suggested that these companies be contacted for such materials.

There are many computer projects going on in various schools around the country. Some of the more widely-known ones are noted by one or more references in this listing; e.g., Dartmouth (Kiewit), CRICISAM, LOCAL. For current information on such projects, the reader may find the monthly column on "New Programs" in The Mathematics Teacher, one of the official journals of the National Council of Teachers of Mathematics, to be helpful.

Marilyn N. Suydam
Editor

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BIBLIOGRAPHY

Part 1. GENERAL EDUCATIONAL ROLE

Abelson, Philip H. Computer-Assisted Instruction. Science 162: 885; November 1968.

Advantages of computer-assisted instruction and the impact of CAI in the future are discussed.

Alpert, D. and Bitzer, D. L. Advances in Computer-Based Education. Science 167: 1582-1590; March 1970. ERIC: EJ 021 630.

Advances in the economic implementation and educational capability of computer-based educational systems (and specifically PLATO) are discussed.

Appleton, Ian F. Computer Education in Secondary Schools. Australian Mathematics Teacher 25: 52-62; March 1969.

A course used in Australian secondary schools is described in detail, with possiblities for further use of computers suggested and a lengthy list of classroom computer problems given.

Arnold, Ron and Penny, Ruth. Who Should Write CAI Curriculum? Educational Technology 9: 88-89; October 1969. ERIC: EJ 011 872.

A project is discussed in which classroom teachers, in daily contact with students, are authoring CAI programs.

Atchison, William F. The Impact of Computer Science Education on the Curriculum. Mathematics Teacher 66: 7, 81-83; January 1973.

The increased use of computers in secondary schools and for teacher education is discussed.

Atkinson, R. C. and Wilson, H. A. Computer-Assisted Instruction. Science 162: 73-77; October 1968.

A brief review of the rapid growth of CAI is given, with several different modes of application characterized and some problems discussed.

Atkinson, Richard C. and Wilson, H. A. (Editors). Computer-Assisted Instruction: A Book of Readings. New York: Academic Press, Inc., 1969. ERIC: ED 034 433. Not available from EDRS.

This is a collection of papers reflecting the trends in research and development in CAI, intended for the reader with no CAI background.

Baker, F. B. Computer-Based Instructional Management Systems: A First Look. Review of Educational Research 41: 51-70; February 1971. ERIC: EJ 033 660.

A number of existing computer systems, their functions, and their level of development are described and compared.

Barnes, O. D. A Computer Assisted Instruction Annotated Bibliography. Bloomington, Indiana: Phi Delta Kappa, Inc., September 1968. ERIC: ED 029 512. Not available from EDRS.

Selected articles dealing with CAI are briefly annotated.

Barnes, O. Dennis and Schrieber, Deborah B. Computer-Assisted Instruction: A Selected Bibliography. Washington: Association for Educational Communications and Technology, March 1972. ERIC: ED 063 769. Hard copy not available from EDRS. Microfiche, 240p.

This book includes citations for 835 journal articles, books, articles from edited books, and technical reports or memos.

Barrett, Richard S. The Computer Mentality. Phi Delta Kappan 49: 430-434; April 1968.

Warnings against the system of beliefs described as the computer mentality are presented, and the effect computers may have on the educational process is discussed.

Becker, James W. It Can't Replace the Teacher - Yet. Phi Delta Kappan 48: 237-239; January 1967.

Although CAI appears promising, little use of it is being made other than as a programmed textbook: more research needs to be done and costs need to be reduced.

Becker, James W. Whatever Happened to the Computer? Journal of Educational Data Processing 8: 3-8; 1971. ERIC: EJ 042 632.

Key problems that remain to be solved in the development of a computer assisted instruction system are discussed.

Bell, Norman T. and Moon, Robert D. Teacher Controlled Computer-Assisted Instruction. East Lansing: Michigan State University, 1969. ERIC: ED 044 028. 27 p. MF and HC available.

Use of the high-cost computer in ways other than as a tutorial tool is discussed: teacher-controlled classroom use, non-tutorial classroom demonstration, simple games, and information retrieval.

Bitzer, Donald L.; Lyman, Elizabeth R.; and Easley, J. A., Jr. The Uses of PLATO: A Computer-Controlled Teaching System. Audio-visual Instruction 11: 16-21; January 1966.

The PLATO system, tutorial and inquiry logics, and university courses using PLATO are discussed.

Blaschke, Charles L. Computers in Education, Interesting, But How Relevant? Educational Technology 9: 24-28; May 1969. ERIC: EJ 005 103.

Changes necessary before computers become part of the school system are depicted, as well as ways computers can aid in strengthening education.

Bright, R. L. The Place of Technology in Educational Change. Audio-visual Instruction 12: 340; April 1967.

A brief description of a computerized classroom is given, with reference to printouts which summarize a student's progress and automatic branching to the next portion of the student's program.

Broderick, W. R. The Computer in School. London: The Bodley Head Ltd., 1968.

This is an account of how a computer department was set up in one school. Included is a discussion of how the computer is used in education and a brief look at the future.

Brudner, Harvey J. Computer-Managed Instruction. Science 162: 970; 1968.

Monetary and education benefits of computer managed instruction vs. computer-assisted instruction are discussed, with the advantages of highly flexible master teaching systems stressed.

Bryan, G. L. Computers and Education. Computers and Automation 18: 16-19; March 1969.

An evaluation of computers in education is given, with three types of activities discussed.

Bryan, Glenn L. Student-to-Student Interaction in Computer Time-Sharing Systems. Computers and Automation 19: 18; March 1970. ERIC: EJ 023 255.

A way in which two or more students may interact with the computer and each other is suggested. Several modes of operation are described including an interactive laboratory experiment.

Bueschel, Richard T. Time-Sharing: A Pragmatic Approach in the School. Educational Technology 10: 21-23; March 1970. ERIC: EJ 020 671.

"What may be expected in the next few years in developments from the field of time-sharing" is discussed. Development, objectives, capabilities, and drawbacks are presented.

Bundy, R. F. Computer-Assisted Instruction: Where are We? Phi Delta Kappan 49: 424-429; April 1968.

Results from CAI research, recommended research areas, generalizations about research, and current trends in CAI are discussed.

Bushnell, Don D. and Allen, Dwight W. (Editors). The Computer in American Education. New York: John Wiley and Sons, Inc., 1967.

Among the chapters are ones on using computers to individualize instruction, computer programming courses in secondary schools, teaching the computer sciences, research, and information processing for educational systems.

Carroll, John M. Carreers and Opportunities in Computer Science. New York: E. P. Dutton and Company, 1967.

Opportunities in computer technology applied to solving problems in manufacturing, transportation, medicine, engineering, and other fields are presented.

Chapman, Joseph Warren. A Determination of the Skills Required of Elementary and Secondary School Teachers in Schools Using Computer-Assisted Instruction. (The American University, 1970) Dissertation Abstracts International 31A: 2785; December 1970.

No uniform "job description" for teachers in CAI appeared feasible, but it was suggested that a set of functions could be identified together with skills required for their performance.

Chorvinsky, Milton. A Discussion of Educational Technology with Emphasis on Computer-Assisted Instruction. Washington: National Center for Educational Statistics, May 1967. ERIC: ED 014 890. 16 p. MF and HC available.

Some of the advantages, limitations and possible applications of CAI systems are mentioned.

Cooley, William W. and Glaser, R. The Computer and Individualized Instruction. Science 166: 574-582; October 1969. ERIC: ED 039 784. Not available from EDRS.

A filing system which aids in individualizing instruction is made possible by the computer. The instructional model used in developing IPI is discussed.

Cooley, William W. Computer Assistance for Individualized Education. Journal of Educational Data Processing 7: 18-28; February 1970. ERIC: EJ 018 768.

The role of the computer in the Individually Prescribed Instruction (IPI) project is described.

Coulson, John E. Computer-Based Instruction. International Review of Education 14: 140-152; 1968.

Various programs set up using computer instruction at various universities and school systems are described, and advantages and disadvantages of CBI are cited.

Coulson, J. E. Computer-Assisted Instruction and Its Potential for Individualizing Instruction. Washington: Academy for Educational Development, Inc., 1970. ERIC: ED 039 705. 30 p. MF and HC avail.

The state of the art in computer-based tutorial systems is presented, after discussion of some strengths and weaknesses of this use of the computer.

Coulson, John E. Computer-Assisted Instructional Management for Teachers. AV Communication Review 19: 161-168; Summer 1971. ERIC: EJ 042 636.

A CMI system designed to aid teachers by monitoring student's performance on behaviorally defined learning objectives is described.

Daly, D. How to Choose a Time-Sharing Service. Computer Design 2: 44-48; 1970.

Characteristics of time-sharing systems and factors involved in determining capabilities and costs are discussed. Included are a table for comparing costs, a list of national time-sharing services, a time-sharing checklist, and a sample rating sheet.

Darby, Charles A., Jr.; Korotkin, Arthur L.; and Romashko, Tania. The Computer in Secondary Schools: A Survey of Its Instructional and Administrative Usage. New York: Praeger Publishers, 1972. ERIC: SE 015 487. Not available from EDRS.

Based on a nationwide survey of secondary schools sponsored by NSF, the study describes the extent and degree of computer use in schools. Statistics on the nature and purpose of computer use, the type and level of support, school characteristics, and plans for future use are included, as is the survey instrument.

Deep, Donald. The Computer Can Help Individualize Instruction. Elementary School Journal 70: 351-358; April 1970. ERIC: EJ 018 306.

The difference between computer-assisted and computer-managed instruction is explained, individualized instruction is defined and discussed, and the computer function in PLAN is described.

Dick, Walter. The Development and Current Status of Computer-Based Instuction. American Educational Research Journal 2: 41-54; January 1965.

Computer instruction projects, equipment, research, problems and prospects are reviewed.

Dick, Walter, et al. Sources of Information on Computer Assisted Instruction. Educational Technology 10: 36-38; March 1970. ERIC: EJ 020 272.

This is a directory of projects dealing with CAI, primarily at the college level, based on a survey intended to uncover fugitive sources of information.

Dyer, Charles A. Preparing for Computer Assisted Instruction. Englewood Cliffs, New Jersey: Educational Technology Publications, 1972. ERIC: ED 055 446. Not available from EDRS.

The general principles of computer operation and the concepts and methods of programming are described in this introductory text aimed at educators with little or no experience in the field of CAI. The book provides a set of steps and several useful devices for implementing most kinds of lessons on a computer.

Edwards, J. B. Mobile Lab Introduces Computer to Students: Computemobile. Nation's Schools 81: 90-91; March 1969.

The mobile lab, supplemented by small computers and by larger time-sharing computers, provides a network service in Oregon.

Fano, R. M. and Corbato, F. J. Time-Sharing on Computers. Scientific American 215: 129-140; September 1966.

The history of time-sharing, possibilities which time-sharing allows, the operation of a time-sharing system, and areas in which improvement is needed are presented, with diagrams and printouts included.

Farina, Mario V. Computers, A Self-Teaching Introduction. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1969.

This book is a self-teaching introduction to the field of digital computer usage, and is appropriate for use by secondary school students.

Feldhusen, John F. and Szabo, Michael. A Review of Developments in Computer Assisted Instruction. Educational Technology 9: 32-40; April 1969. ERIC: EJ 004 690.

Provided are 61 references published from 1963-1968 giving information on CAI research and development, theoretical bases for CAI, types of CAI systems, languages, cost factors, and descriptions of CAI programs.

Ferguson, Richard Leroy. The Development, Implementation, and Evaluation of a Computer-Assisted Branched Test for a Program of Individually Prescribed Instruction. (University of Pittsburgh, 1969.) Dissertation Abstracts International 30A: 3856; March 1970. ERIC: ED 034 406. Not available from EDRS.

The described branched test could provide the same information for the mathematics unit studied as a conventional paper-and-pencil test in one-half the time and with substantially greater reliability in aiding instructional decision-making.

Finch, John M. Computer-Managed Instruction: An Annotated Bibliography. Audiovisual Instruction 17: 72-74, 76; March 1972. ERIC: EJ 059 165.

Twenty-eight references published since 1968 are listed, with special emphasis on Project PLAN and IPI.

Flanagan, John C. The Role of the Computer in PLAN. Journal of Educational Data Processing 7: 7-17; February 1970. ERIC: EJ 018 767.

The role of the computer in PLAN is described; this is a CMI system to assist the student to take as much responsibility as possible in the planning of his own education.

Geddes, Cleone L. and Kooi, Beverly Y. An Instructional Management System for Classroom Teachers. Elementary School Journal 69: 337-345; April 1969. ERIC: EJ 002 686.

An instructional management system in which the computer provides daily reports of individual students' progress, used during 1967-68 in two first grades, is described.

Gentile, J. Ronald. The First Generation of Computer-Assisted Instruction Systems: An Evaluative Review. Audiovisual Communications Review 15: 23-53; Spring 1967.

This is a review of what has been done in CAI and its effectiveness.

Gerard, Ralph W. (Editor). Computers and Education. New York: McGraw Hill, 1967. ERIC: EJ 031 234.

This report of a conference at the University of California-Irvine includes a survey of development in computer-assisted instruction, library utilization, and administrative record-keeping procedures.

Gibb, E. Glenadine. The Computer - A Facilitator in Management and Instruction. Mathematics Teacher 66: 6, 78-80; January 1973.

The role of the computer in individualizing instruction, as a facilitator of instructional management, and as a facilitator of instructional assistance are discussed.

Glauberman, M. H. Computers in Education: An RCA Viewpoint. Educational Technology 9: 63-66; September 1969. ERIC: EJ 010 594.

The potential of the computer in the classroom is discussed.

Goodlad, John I; O'Toole, John F., Jr.; and Tyler, Louise L. Computers and Information Systems in Education. New York: Harcourt, Brace and World, Inc., 1966. ERIC: ED 033 584. Not available from EDRS.

This report of a conference at Lake Arrowhead, California, describes how computers work and what they can and cannot do. Innovative uses of electronic data processing in education are presented, with a discussion of the traditional and the changing roles of teachers.

Goodman, Edith H. Automated Education Handbook. Detroit: Automated Education Center, 1965.

Included in this handbook are chapters on CAI research, specifications, materials, and costs.

Gordon, Robert M. Computer-Assisted Instruction: Some Operational Aspects. Datamation 15: 37; January 1969.

A look at CAI at the college level is presented with emphasis on programs. The problems of faculty time and economics are discussed.

Grayson, Lawrence P. The U. S. Office of Education and Computer Activities: A Summary of Support. Educational Technology 11: 51-54; November 1971.

Described is USOE's financial support since 1965 of computer projects in computer-presented instruction, problem solving, instructional guidance and management, long-term training and curricula, short-term training, specialized data development and analysis, automatic data processing, information management and retrieval, administration and organization, networks, and consortia.

Hagerty, Nancy K. Development and Implementation of a Computer Managed Instructional System in Graduate Training. Tallahassee: Florida State University Computer Assisted Instruction Center, June 1970. ERIC: ED 042 354. 182 p. MF and HC available.

A graduate level course using CMI to teach the techniques of programed instruction was developed and tested.

Handy, H. W. et al. The Computer in Education. Washington: Educational Service Bureau, Inc., 1970. ERIC: ED 055 338. Not available from EDRS.

Some computer applications in instruction, pupil and staff records processing, and management and administrative decision-making are suggested, and a curriculum for computer science education is presented.

Hansen, D. N. Computer Assistance with the Educational Process. Review of Educational Research 36: 588-603; December 1966.

This review focusses on theoretical and experimental development that used CAI as a research tool or as an educational system.

Hansen, Duncan N. and Harvey, William L. Impact of CAI on Classroom Teachers. Educational Technology 10: 46-48; February 1970. ERIC: EJ 016 694.

An analysis of some of the factors within CAI that may cause changes in teacher role is presented.

Haraseyko, H. and Fanning, J. E. Information Systems Science: Challenge to Education. Science Teacher 36: 31-35; January 1969. ERIC: EJ 001 192.

Predictions of how computers will influence society are presented.

Harnack, Robert S. Teacher Decision Making and Computer-Based Resource Units. Audiovisual Instruction 12: 32-35; January 1967.

The use of a computer as a resource from which a teacher may get ideas for instructional aids for certain teaching units is described.

Hartman, Edward. The Cost of Computer Assisted Instruction. Educational Technology 11: 6-7; December 1971. ERIC: EJ 050 578.

The cost of CAI and the circumstances under which a school system should consider installing such equipment are discussed.

Heilman, Carl E. Challenge, Enrich and Motivate with Computers. Science Teacher 33: 21-25; March 1966.

Details on how to obtain a computer and applications are included.

Hickey, Albert E. (Editor). Computer-Assisted Instruction Guide. Newburyport, Massachusetts: ENTELEK, 1968. ERIC: ED 022 687. Not available from EDRS.

Provided is a compilation of abstracts of available CAI programs; a total of 226 programs in thirty subject matter areas are categorized. A Survey of the Literature is also available.

Hill, Russell H. and Furst, Norma. Teacher Behavior in CAI Classrooms. Educational Technology 9: 60-62; September 1969. ERIC: EJ 010 945.

The activities of the teacher in the CAI class are discussed.

Holden, George S. The Effects of Computer Based Resource Units Upon Instructional Behavior. Journal of Experimental Education 37: 27-30; Spring 1969. ERIC: EJ 006 329.

Teachers who used the resource units increased the number and improved the quality of individualized instruction tasks as determined by an experimental design using trained observers.

Holtzman, Wayne H. (Editor). Computer Assisted Instruction, Testing and Guidance. New York: Harper & Row, 1970. ERIC: ED 064 861. Not available from EDRS.

This is a collection of 20 papers presented at a conference held at Austin, Texas in 1968. For a review of this book, see ERIC: EJ 048 972.

Hunka, S. Training and Research Program in Computer Applications. Edmonton, Alberta: University of Alberta, 1967. ERIC: ED 015 882. 8 p. MF and HC available.

Researchers and teachers used computers during off-duty hours for a school year. Topics included computer applications, programming, and Coursewriter and APL languages.

Jamison, D.; Suppes, P.; and Butler, C. Estimated Costs of CAI for Compensatory Education in Urban Areas. Educational Technology 10: 49-57; September 1970. ERIC: EJ 028 486.

Cost-effectiveness and utilization of the ESEA Title III-funded CAI system for New York City (1968-1969) are described. An indication of high cost-effectiveness in compensatory education in the future is projected.

Johnson, T. Learning How to Apply the First True Random-Access Learning System. Audiovisual Instruction 16: 78-81; October 1971.

Described is the first installation of PYRAMID (Program Yielding Rapid Access Major Information Device), a computer-controlled library of taped audio and visual suplementary instructional materials accessible from individual carrels.

Kanner, J. H. CAI - The New Demonology? Datamation 14: 38-40, September 1968.

A realistic look is taken at some claims for CAI which are not supported.

Karplus, Walter J. On-Line Computing. New York: McGraw-Hill, 1967.

A perspective of the time-sharing computer field is given, with special emphasis on applications requiring man-computer interaction.

Kerr, Eugene G; Ting, T. C.; and Walden, William E. An Instructional System for Computer Assisted Instruction on a General Purpose Computer. Educational Technology 10: 28-30; March 1970. ERIC: EJ 020 270.

A Washington State University interactive CAI system using FORTRAN is described, with examples of computer-student interaction.

Kleiner, George. Development of Specifications for a Low Cost Computer System for Secondary Schools. Final Report. Hoboken, New Jersey: Stevens Institute of Technology, Computer Center, May 1971. ERIC: ED 061 768. 76 p. MF and HC available.

This report surveys the various means of implementing a computer resource: commercial time-sharing, small-scale time-sharing systems, multi-use minicomputers, and minicomputer systems. Each approach is analyzed for cost, support required, number of students supported. How the students made use of the resource and its educational limitation

are also reviewed. The implementation of high level languages, such as FORTRAN and BASIC, are considered for their educational utility and the number of students they can support. A survey of minicomputers and suitable peripheral equipment is appended.

Koch, Warren J. Using Time-Sharing Computers in Secondary Schools: A Satus Report. NASSP Bulletin 56: 46-54, April 1972. ERIC: EJ 057 401.

The advantages of shared-time computer use and some of the uses to which computer assisted instruction has been put are described.

Kopstein, Felix F. Computers and Instruction at HumRRO. Educational Technology 9: 25-28; July 1969. ERIC: EJ 007 404.

Presented is the theoretical base of Project IMPACT (Instructional Model Prototypes Attainable in Computerized Teaching), designed to be economically competitive while achieving highly individualized instruction.

Kopstein, Felix F. Why CAI Must Fail! Educational Technology 10: 51-53; March 1970. ERIC: EJ 020 273.

This editorial argues that the American system of decentralized educational control will be responsible for CAI's being a pronounced failure in the future, because of the cost factor.

Kriewall, Thomas Edward. Applications of Information Theory and Acceptance Sampling Principles to the Management of Mathematics Instruction (The University of Wisconsin, 1969.) Dissertation Abstracts International 30A: 5344; June 1970. ERIC: ED 038 306. 191 p. MF and HC available.

The systems approach, test theory, and the development of computer-managed instruction are analyzed as needed components of programs featuring self-selection and self-pacing.

Lekan, Helen A. (Editor). Index to Computer Assisted Instruction. Boston: Sterling Institute, 1970. ERIC: ED 028 650. Not available from EDRS. (Also, Milwaukee: University of Wisconsin, 1969.)

This is a compilation of CAI programs and projects. Information includes program name, author, source, description, level of instruction, use of program, availability of program, language programmed in, and other data.

Lewellen, Lee. Computers in the Classroom. Journal of Educational Data Processing 8: 33-38; 1971. ERIC: EJ 044 501.

A brief survey of the current usage of computers as an instructional tool is given.

Lichten, William. Development of New Instructional Uses of the Computer in an Inner-City Comprehensive High School. Final Report. New Haven: Yale University, 1971. ERIC: ED 057 597. 230 p. MF and HC available.

The use of computers at an inner-city high school was investigated. It was found that a wide variety of students benefited from using BASIC with a teletype terminal. The majority of the students in a select group mastered the basid features of FORTRAN in a one-week period. Methods of training teachers to use computers as a tool of instruction was also studied.

Llana, Andres, Jr. Computer Time Sharing - A Practical Approach to Computers in Education. College and University 45: 55-62; Fall 1969. ERIC: EJ 014 747.

This is a report on time-sharing developments, particularly at Dartmouth. Attempts to assess the value of this kind of program in other locales are made.

Lockard, J. David. Computers in Undergraduate Education: Mathematics, Physics, Statistics, and Chemistry. College Park: University of Maryland, December 1967. ERIC: ED 025 440. 82 p. MF and HC available.

This is a report on an NSF-sponsored conference at which the importance and uses of the computer in mathematics and other fields were discussed.

Luskin, Bernard Jay. An Identification and Examination of Obstacles to the Development of Computer Assisted Instruction. (University of California, Los Angeles, 1970.) Dissertation Abstracts International 31B: 3980-3981; January 1971.

Availability of individuals with appropriate skills, sufficient funds, faculty attitudes and incentives, and poor documentation of programs were among the obstacles cited as critical in the adoption of CAI.

Lynch, Robert Michael. A Cost Effectiveness Analysis of Computer Assisted Instruction. (University of Northern Colorado, 1971.) Dissertation Abstracts International 32B: 839; August 1971.

Cost analysis of several computer systems indicated that CAI can be an effective tool for education and can be justified economically in institutions of higher education if the demand for CAI instruction time is extremely large.

Margolin, Joseph B. and Misch, Marion R. Education in the Seventies, A Study of Problems and Issues Associated with the Effects of Computer Technology on Education. Washington: George Washington University, October 1967. ERIC: ED 022 361. 330 p. MF and HC available.

This is a report by a panel of ten scientists and educators who inspected CAI projects at seven research and development centers.

Mitzel, Harold E. How to Evaluate Computer Assisted Instruction. University Park, Pennsylvania: The Pennsylvania State University, November 1970. ERIC: ED 047 005. 6 p. MF and HC available.

Some questions to be considered in evaluating CAI are presented and briefly discussed.

Molenda, Michael H. How a School System Gets Into CAI. Audiovisual Instruction 16: 86-87; June/July 1971. ERIC: EJ 047 465.

This is a brief review of some of the procedures and pitfalls involved in implementing a CAI project in a hypothetical school system.

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This is a review of the uses of computers in many educational fields.

Molnar, Andrew R. and Sherman, Beverly. U. S. Office of Education Support of Computer Activities. Educational Technology 9: 5-9; April 1969.

A general summary of USOE's support of projects on computers in education during 1967-69 is given.

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The relevance of the computer to academic disciplines is discussed and a list of over 200 programs is presented.

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This is a rather devastating critique of those who think that machines of any kind can replace a teacher.

Oettinger, Anthony and Marks, Sema. Educational Technology: New Myths, and Old Realities. Harvard Educational Reveiw 38: 697-755; Fall 1968. ERIC: ED 034 423. Not available from EDRS.

The way computers and other technology are used is considered. Limitations of the Stanford CAI system are noted and the time factor in developing CAI materials is decried.

O'Neal, Fred. The Role of Public Schools in Computer Assisted Instruction: Individualized Instruction in a Kansas City Junior High School. Educational Technology 10: 5-10; March 1970. ERIC: EJ 020 268.

This is a report by a project director indicating the use of the computer in the Kansas City Schools; the use in mathematics instruction is included.

Osborne, Adam. The Potential Use of Minicomputers in Education. Journal of Educational Data Processing 8: 1-10; 1971. ERIC: EJ 054 474.

The use of minicomputers is discussed, followed by consideration of factors to consider before investing in minicomputers.

Razik, Taher A. (Editor). Bibliography of Programmed Instruction and Computer Assisted Instruction. Englewood Cliffs, New Jersey: Education Technology Publications, 1971. ERIC: ED 048 724. Not available from EDRS.

Both published and unpublished articles are cited (1954-1969). CAI articles are listed separately; no annotations are included.

Resta, Paul E. et al. Instructional Management Systems Using Computers. Audiovisual Instruction 16: 28-31; December 1971. ERIC: EJ 052 055.

The components of descriptive and prescriptive computer-based systems designed to aid teachers in the management of instruction are identified, and the tasks for which computer support is appropriate are described.

Richardson, Robert J. An Information System for Individualized Instruction in an Elementary School. Educational and Psychological Measurement 29: 199-201; Spring 1969. ERIC: EJ 004 669.

A preliminary version of a computer-oriented information system to assist IPI is described.

Roberts, Arthur D. and Ziekel, Perry Alan, Computer Applications to Instruction. Journal of Secondary Education 46: 99-105; March 1971.

A brief, elementary description of the computer's uses in drill-and-practice, tutoring, inquiry, problem-solving, simulation, and other roles is presented.

Rogers, James L. Current Problems in CAI. Datamation 14: 28-33; September 1968.

This is a review of CAI, its various uses, and difficulties such as the lack of common characteristics among CAI hardware and software.

Salisbury, Alan B. An Overview of CAI. Educational Technology 11: 48-50; October 1971. ERIC: EJ 047 473.

The several modes, parameters, instructional logic, and instructional decision rules of CAI are described.

Shure, Alexander. A System for the Individualization and Optimization of Learning Through Computer Management of the Educational Process. Final Report. New York: New York Institute of Technology, Inc., June 1971. ERIC: ED 059 628. 418 p. MF and HC available.

A model for the monitoring and management of the instructional program was developed and is described in some detail.

Seidel, Robert J. Is CAI Cost/Effective? The Right Question at the Wrong Time. Educational Technology 9: 21-23; May 1969. ERIC: EJ 005 537.

The question is viewed as inappropriate within a system constrained by traditional classrooms, school days, and school administration. Radical changes in instructional methods and administration are predicted, and it is claimed that the technical problems of CAI will not be cost-prohibitive.

Spencer, Donald D. Computers: Past, Present, and Future. Mathematics Teacher 61: 65-75; January 1968.

The history of computers, the anatomy of a computer, software, computer language, computer manufacturers, time-sharing, applications, costs, and the future of computer science are all discussed.

Sponberg, Ruth Ann. You and CAI - How is Educational Technology Going to Affect YOU the Teacher? Where Does Computer-Assisted Instruction Stand Today. Instructor 76: 170-171; August/September 1967.

Questions which the teacher is likely to have about CAI are answered, with illustrations of different tasks which a computer can be used for in a school.

Starkweather, John A. Computer Science Instruction in Elementary Grades, An Exploration of Computer-Based Learning Methods. Final Report. San Francisco: University of California, January 1968. ERIC: ED 021 445. 199 p. MF and HC available.

An exploratory phase in which junior and senior high school students constructed instructional programs was followed by an investigation of the effectiveness of CAI in the development of social studies problem solving skills at the eighth grade level.

Stolurow, Lawrence M. Project SOCRATES: A Flexible Research Facility to be Used in Studies of Pre-Programed Self Instruction (PSI) and Self-Programed Individualized Education (SPIE). Final Report. Urbana: Training Research Laboratory, University of Illinois, 1966. ERIC: ED 021 457. Not available from EDRS.

Research is reported on the development of psychological theory and the design and use of a computer-based instructional system.

Stolurow, Lawrence M. Computer Assisted Instruction. Detroit: American Data Processing, Inc., 1968.

This book contains an overview of computer assisted instruction.

Suppes, Patrick. Computer-Assisted Instruction in the Schools: Potentialities, Problems, Prospects. Stanford: Institute for Mathematical Studies in Social Sciences, Stanford University, October 1965. ERIC: ED 021 482. 18 p. MF and HC available.

The potential for computer use in skill subjects, the hope it provides for accommodating individual differences, and the relief from routine record-keeping it can provide are cited. Problems include machine reliability and costs, the need for audio messages, and the need for sound programs.

Suppes, Patrick and Jerman, Max. Computer-Assisted Instruction. NASSP Bulletin 54: 27-40; February 1970. ERIC: EJ 015 945.

What CAI is and what it can do are discussed. Prospects for future work and an overview of some significant research are presented.

Swets, John A. and Feurzeig, Wallace. Computer-Aided Instruction. Science 150: 572-576; October 1965.

The "Socratic System" where the computer states a problem and then provides a framework in which a student can proceed to solution was explained, with examples.

Thompson, Keith K. and Waterhouse, Ann. The Time-Shared Computer: A Teaching Tool. NASSP Bulletin 54: 91-98, February 1970. ERIC: EJ 015 519.

A project in which the computer is used in the classroom is discussed, indicating advantages, such as increased motivation, as well as problems.

Ting, Tuz-chin. The Development of a Computer-Assisted Instructional System. (Washington State University, 1969.) Dissertation Abstracts International 30B: 4592; April 1970.

A university interactive computer system for instruction, recording, and management is described.

Unwin, Derick and Atkinson, Frank. The Computer in Education. London: The Library Association, 1968.

This is an annotated bibliography of 424 selected books, reports, and papers which relate to computers, computers as teaching aids, and computer languages.

Walton, Wesley W. Computers and Education: A Bibliography. NASSP Bulletin 54: 78-84; February 1970. ERIC: EJ 016 173.

A list of published works on computers and their use in education is given.

Wexer, Jonathan David. A Generative, Remedial, and Query System for Teaching by Computer. (University of Wisconsin, 1970.) Dissertation Abstracts International 31B: 2623-2624; November 1970.

A computer-based teaching system, writen in ALGOL, is described. It operated in three modes: teacher (a set of information and constructs), student (a CAI program), and dialogue (for student-browsing).

White, P. T. Behold the Computer Revolution. National Geographic 138: 593-633; November 1970.

This is an interestingly written and pictured discussion of various computer uses, providing general background.

Winkler, Clifford E. Computer Time-Sharing Feasible for Classwork. Nation's Schools 86: 94-96; October 1970. ERIC: EJ 027 017.

Cooperative purchasing and the use of mark sense card readers to enable schools to afford the best computers available for use in classroom work are recommended.

Wittig, Lester. A Model for the Development of a Learning Module for Computer-Assisted Instruction. Audiovisual Instruction 15: 22-24. January 1970. ERIC: EJ 016 630.

Guidelines for testing the validity and effectiveness of a CAI module are given.

Wolfe, Lee R. Computer Concepts Possessed by Seventh-Grade Children. Arithmetic Teacher 15: 35-39; January 1968.

Eight major misconceptions are cited, with several suggestions that could be used to provide computer experiences in the schools so as to avoid these misconceptions.

Young, Robert Manning. Perceptions of Selected Groups of Educators with Regard to the Usefulness of a Computer in Education. (Wayne State University, 1972.) Dissertation Abstracts International 33A: 2059-2060, November 1972.

The computer is viewed as being very useful in mathematics, while its usefulness in other subject areas is viewed with uncertainty.

Ziegler, J. R. Time-Sharing Data Processing Systems. Englewood Cliffs, New Jersey: Prentice-Hall, 1967.

This is a comprehensive review of the practical implications of time-sharing data processing techniques.

Zinn, Karl L. Computer Technology for Teaching and Research on Instruction. Review of Educational Research 37: 618-634; December 1967.

Six categories are reviewed: modes of computer assistance for the student, strategies for computer-based learning situations, computer aids for instructional management, computer-based tools for authors and researchers, computer-aided design of learning situations, and trends and projected needs.

Carl L. A Basic Reference Shelf on Interactive Use of Computers for Instruction. Stanford: ERIC Clearinghouse, September 1968. ED 025 135. 31 p. MF and HC available.

Sources of information on computer-based instructional systems are listed under literature surveys and reviews, conferences and symposia, periodicals, and professional organizations.

and McClintock, S. A Guide to the Literature on Interactive Uses of Computers for Instruction. Ann Arbor: Center for Research on Learning and Teaching, University of Michigan, 1970.

Terminologies and modes of computer use in education, advantages and limitations and lists of literature surveys, reviews, societies, and services are included.

---. Computer Education for Teachers in Secondary Schools, An Outline Guide. Geneva, Switzerland: International Federation for Information Processing, September 1971. ERIC: ED 058 889. 29 p. MF and HC available.

This guide is intended for those who are concerned with the planning of computer courses for the training of teachers. Suggestions for content and methods are included. Included are the study of the computer itself and some indications of the influence of the computer within subject areas and its effect on society. The guide can be used by informed teachers when preparing courses for secondary school children.

---. Computer Education and Training Reference Guide. Oceanport, New Jersey: Edumatics Corporation, 1972. ERIC: ED 061 765. Not available from EDRS.

This guide lists commercially available products and services in the field of computers and education. Manufacturers' reports on educational computer systems, computer training devices and instructional aids, computer schools and courses, instructional systems, services and accessories are listed by sections.

---. The Computer in Education. Dayton, Ohio: Institute for Development of Educational Activities, 1970. ERIC: ED 054 619. Not available from EDRS.

Outcomes from a seminar including experts in CAI are presented, including a comprehensive statement concerning the value of computers in schools, a description of the system approach, and an outline of the essentials of computer operation. The need for guidelines and the problem of costs is noted.

---. Cost Study of Educational Media Systems and Their Equipment Components: Volume III, A Supplementary Report: Computer Assisted Instruction. Final Report. Washington: General Learning Corporation, May 1968. ERIC: ED 024 281. 114 p. MF and HC available.

A model for calculating the minimum cost of performing specified instructional tasks was developed; data for CAI is presented. It was concluded that CAI can be economically justified only if it becomes the dominant mode of instruction in a given instructional environment.

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A formal programming language for writing and checking proofs is defined and its computer processing requirements are specified. Attempts at verifying some simple semantic inferences for a discourse on finite geometry are reported.

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Albrecht, Robert L.; Lindberg, Eric; and Mara, Walter. Computer Methods in Mathematics. Reading, Massachusetts: Addison-Wesley, 1969.

This text provides an introduction to computers and programming languages, presents BASIC and FORTRAN, and includes examples and exercises at varying levels of difficulty, complete with flowcharts and computer solutions.

Allison, Ronald. Computer Programming for the Seventh Grade. Mathematics Teacher 66: 17-19; January 1973.

A two- to three-week unit of computer instruction is described and evaluated.

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Scores on tests of temperament, programming aptitude, and critical thinking, together with SCAT scores and a measure of mathematical background, were correlated with achievement on an introductory programming course.

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Wilkes, P. N. and Tinsley, J. D. Practical Programming. Cambridge, Massachusetts: Cambridge University Press, 1968.

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Tropley, A. J. and Gross, P. F. The Effectiveness of Computer-Assisted Instruction. Alberta Journal of Educational Research 16: 203-210; December 1970. ERIC: EJ 032 161.

University students receiving instruction in FORTRAN via CAI were compared to groups receiving conventional lectures and programmed instruction. All three were found equally effective with no serious negative feelings reported toward machine instruction.

Wood, C. B. An Introduction to Electronic Computers. New York: McGraw-Hill, 1965.

Computer programming with FORTRAN and COBOL is presented.

Dennis, John David. Some Considerations in the Design of Computer Languages for Interactive Problem Solving. (The Ohio State University, 1971.) Dissertation Abstracts International 32B: 4611; January 1972.

An actual problem-solving situation was analyzed to determine how students used computer languages in solving problems and what modifications should be made in the languages.

Dimitry, D. L. and Moot, T. H., Jr. Introduction to FORTRAN IV Programming. New York: Holt, Rinehart and Winston, 1966.

Dorn, William S. and Gree[illegible] Herbert J. Mathematics and Computing: With FORTRAN Programmi[illegible] New York: John Wiley and Sons, Inc., 1967.

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Feurzeig, Wallace and Lukas, George. LOGO - A Programming Language for Teaching Mathematics. Educational Technology 12: 39-46; March 1972. ERIC: EJ 057 841.

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This is a supplement to Computer Science: A Primer and A First Course by the same authors, with constant reference to the textbooks. Many illustrative problems are included.

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Characteristics of APL, its relation to other popular problem-solving languages, and its uses in education as well as in general problem solving are discussed.

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Higgins, G. A. The Elementary Functions: An Algorithmic Approach. Hanover, New Hampshire: Dartmouth College, 1970.

This course integrates use of a computer, using BASIC.

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This computer science text emphasizes FORTRAN, and includes examples that could be used in mathematics classrooms.

Iverson, Kenneth E. Elementary Functions: An Algorithmic Treatment. Chicago: Science Research Associates, 1966.

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This is a comprehensive sourcebook on APL programming and includes examples.

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The BASIC language, time-sharing, and debugging are presented, followed by eleven chapters on applications.

Killen, Michael. Introduction to Programming - A Mathematical Approach. Tewksbury, Massachusetts: Wang Laboratories, 1969.

Several mathematical units for use with the Wang 370 Computing System are included, for use in algebra 2 or more advanced courses.

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A complete description and analysis of FORTRAN IV are given, with motivating examples and problems relevant to the work of the behavioral scientist.

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A course is proposed for the mathematics student; included are objectives, prerequisites, methods, teaching aids, binary system, computation principles, and machine operation.

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This easy-to-read book relates different computer languages and their uses, and traces the growth in complexity of computers.

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Pennington, Ralph H. Introductory Computer Methods and Numerical Analysis. New York: Macmillan, 1965.

This college-level text has some settings with implications for secondary school mathematics.

Price, Wilson T. and Miller, Merlin. Elements of Data Processing Mathematics. New York: Holt, Rinehart and Winston, Inc., 1967.

This book is for students with a vocational interest in the fields of data processing and computer programming. The emphasis is on problem solving rather than proof.

Ralston, A. and Wilf, H. A. Mathematical Methods for Digital Computers, Volumes I and II. New York: John Wiley and Sons, Inc., 1967.

This is an advanced reference text for the teacher, with mathematical discussion of topics followed by a series of related topics for a computer user.

Rounds, Sue. Fifth and Sixth Graders Program a Computer. Instructor 77: 53; April 1968.

In a summer activity program, superior students were taught the binary system, what a computer is and its limitations, and some BASIC language, and wrote and tested at least two computer programs.

Rule, Wilfred P. FORTRAN IV Programming. Boston: Prindle, Weber & Schmidt, 1968.

This book contains many sample engineering applications; no previous computer background is assumed.

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Each chapter is self-contained, and emphasizes those features of a language that can be used on more than one type of computer; a set of exercises is included. The languages covered are: ALGOL 60, FORTRAN, COBOL, PL/1, and Extended Mercury Autocode; a short introduction is also included for BASIC.

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Skelton, John E. An Introduction to the BASIC Language. New York: Holt, Rinehart & Winston, 1971.

Smith, Robert E. The Bases of FORTRAN. Minneapolis: Control Data Corportation, 1967.

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Smith, Robert E. Card FORTRAN Without Keypunch. Minneapolis: Control Data Corporation, 1967.

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This text includes 41 lessons and 50 review problems in BASIC.

Smith, Robert E. Discovering BASIC: A Problem Solving Approach. New York: Hayden Book Co., 1970.

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This dictionary contains 1200 entries and many tables, number conversion techniques, lists of computers, and other information.

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45/46

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The EIN (Educational Information Network) is a non-profit operations which coordinates the sharing of educational computing resources. Through its catalog, software (programs) are offered for distribution. Prices are indicated.

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## Part 3. MATHEMATICS INSTRUCTION APPLICATIONS

### A. Teaching About Computers

Ackerman, Judy. Computers Teach Math. Arithmetic Teacher 15: 467-468; May 1968.

The use of game-learning computers in sixth grade mathematics classes is described. The game uses memory and storage with cards, cups, and marbles.

Allen, Paul, III. Exploring the Computer. Reading, Massachusetts: Addison-Wesley, 1967.

This is an elementary programmed introduction to computer hardware.

Alspaugh, John W. The Relationship Between High School Algebra and the Algebra of Computers. School Science and Mathematics 68: 193-198; March 1968.

Among the differences between algebra and computer-algebra are (1) computers generally do not perform algebraic manipulation but do perform indicated operations, and (2) computers make decisions according to if-then instructions.

Andree, Richard V. Computers and Inservice Education. Mathematics Teacher 61: 711-712: November 1968.

Some of the many difficulties encountered when applying mathematical theory to the computer are explained, with examples used to illustrate how the computer demands more stress on understanding of algorithms, basic definitions, and numerical theorems.

Bell, Frederick H. Building a Conceptual Computer. Mathematics Teacher 65: 57-60; January 1972. ERIC EJ 049 030.

A novel way of teaching elementary computer science to secondary school students is presented, with the format for the first lesson included.

Bolt, A. B. and Wardle, M. E. Communicating with a Computer. London: Cambridge University Press, 1970.

This is an elementary introduction to what a computer is and how it works.

Bolt, A. B. et al. We Built Our Own Computers. London: Cambridge University Press, 1966.

This book, written by students, encourages others to experiment in constructing computers. Many diagrams are included for simple computers.

Buchman, Aaron L. The Use of Calculators and Computers in Mathematics Instruction in New York High Schools. School Science and Mathematics 69: 385-392; May 1969. ERIC: EJ 003 641.

The results of a survey conducted during 1967-8 to determine the usage of calculators and computers in programs of mathematics instruction in New York State secondary schools are given. Only 13 per cent of the schools reported having calculators in the mathematics department, with two per cent of these having computer features. Five per cent of the schools had computer facilities which were used by mathematics classes.

Crowley, Thomas H. Understanding Computers. New York: McGraw-Hill, 1967.

This is an introduction to how a computer works.

Delaney, Arthur A. A Computer Activity for the Classroom. School Science and Mathematics 66: 255-258; March 1966.

A simplified computer which can be used to illustrate AND and OR functions is described.

Desmonde, William H. Computers and Their Uses (Second Edition). Englewood Cliffs, New Jersey: Prentice-Hall, 1971.

This book is about computing but not about programming. Essays concerning the automated state, the organization of memory, circuit logic, information patterns, and varied uses of computers are included.

Franta, W. R. Computer Arithmetic. Mathematics Teacher 64: 409-414; May 1971. ERIC: EJ 038 331.

Characteristics of computer arithmetic that may cause programming problems are considered. How numbers are stored in a computer, round-off error, overflow, and double-precision arithmetic are among the topics considered.

Gibney, Thomas C. and Lengel, Judith A. Utilizing a Flow Chart in Teaching Ninth Grade Mathematics. School Science and Mathematics 68: 292-296; April 1968.

The use of flow charts in solving problems involving basic arithmetic operations is presented, as an aid in analysis of problems.

Guttersen, Gransville. A Computer for Every Classroom. Mathematics Teacher 59: 356-357; April 1966.

How a computer can be constructed from an old gasoline pump for use in the classroom is described. It can be used to check multiplication.

Hausner, Melvin. On an Easy Construction of a Computing Machine. Mathematics Teacher 59: 351-355; April 1966.

Having college class members act out computer decisions is proposed, with an example of the class becoming a prime-generating machine. A list of steps and a flow chart are included in addition to a FORTRAN II program.

Henle, James M. You Too Can Be a Computer, or Part of One. Mathematics Teacher 65: 553-559; October 1972.

A computer simulated by students is described, with sample "programs" presented.

Hughes, J. L. and Engvold, K. J. Hexapawn: A Learning Demonstrator. Datamation 14: 67-73; March 1968.

A simple demonstration program for explaining to the uninitiated how a computer can "learn" through experience is included.

Kessler, Bernard M. A Discovery Approach to the Introduction of Flow-Charts in the Elementary Grades. Arithmetic Teacher 17: 220-224; March 1970.

How to introduce flowcharts and some samples made by elementary school children are included.

Kissinger, Paul B. A Human Computer. Science and Children 7: 18-20; April 1970. ERIC: EJ 020 916.

A simple classroom activity for demonstrating the binary system, addition and subtraction of binary numbers, simple logic operations, the role of on-off switches, and computer applications is explained. The computer is "constructed" using human components.

Krulik, Stephen. Using Flow Charts with General Mathematics Classes. Mathematics Teacher 64: 311-314, April 1971. ERIC: EJ 037 744.

Flow charting symbols and how to use them in four charts are presented.

Leonard, William A. A Student Computer That Really Works. Mathematics Teacher 63: 681-684; December 1970. ERIC: EJ 031 269.

A base-two demonstration with students is presented.

McDermott, John J. Sample "Computer". Arithmetic Teacher 16: 177-178; March 1969. ERIC: EJ 002 721.

A simulated computer, using only paper-and-pencil procedures, is described.

Moursund, David G. How Computers Do It. Belmont, California: Wadsworth Publishing Co., 1969.

This book emphasizes algorithm design and flow charts to illustrate how the computer can be used to solve problems.

Nikolaieff, George A. (Editor). Computers and Society. New York: H. W. Wildon Company, 1970.

Articles and excerpts answer many basic questions about what a computer is, how it works, and how it came about in the first place.

Overholser, Jean S. Flow Charts for the Elementary Grades. Arithmetic Teacher 13: 591-593; November 1966.

Relay games are suggested as an introduction to flow charting.

Pagni, David L. The Computer Motivates Improvement in Computational Skills. Arithmetic Teacher 18: 109-112; February 1971. ERIC: EJ 033 647.

A classroom activity using computer programming techniques as motivation for computational practice in grades 4-8 is described.

Pierce, John R. The Transmission of Computer Data. Scientific American 215: 144-156, September 1966.

The communication system used by computers is explained. Included are the development of the present system, means of transmission, what is needed, and obstacles to overcome.

Smith, Eugene and Hirsh, Joseph. Computer Mathematics (A Unit for Grades 8 Through 12). Birmingham, Michigan: Midwest Publications Company, 1966.

A two-week unit on how a computer works is presented, with topics such as the binary system, coding, floating point arithmetic, computer programming and history.

Thompson, Gerald A. Computers and the Use of Base Two in the Memory Unit. Arithmetic Teacher 16: 179-181; March 1969. ERIC: EJ 002 722.

A lesson to familiarize students with the various components of a computer system, demonstrate how some of these components function, and provide an understanding of the use of base two in the memory unit of a computer system is presented.

## B. General Uses

Austin, Malcolm C. Computers in Mathematics Education. Audiovisual Instruction 14: 44-45; May 1969.

Illustrations of how computers were used in the elementary school classroom are given, with students generating their own problems in sixth grade.

Berryman, J. P. Computer Science - A Threat? Mathematics Teaching 57: 21-23; Winter 1971. ERIC EJ 048 441.

Since computer science is not a branch of mathematics, responsibility falls to the mathematics teacher to determine which aspects of it (e.g., algorithmic procedures, flow-charting, rapid calculation) and which languages (e.g., BASIC, FORTRAN, PL/1, ALGOL) are most suitable for teaching mathematical concepts. Several examples are included.

Bishop, Thomas David. A Study of the Computer-Related Mathematics Programs of Secondary Schools and Teacher Education Institutions in Missouri and Adjoining States. (University of Missouri-Columbia, 1970.) Dissertation Abstracts International 31A: 3997-3998; February 1971.

Thirty per cent of the schools offered technically-oriented computer-related courses; 20 percent used computer time for enrichment and supplementary activities; only one school used the computer for tutorial instruction. Two-thirds of the colleges had a recommended computer-related mathematics course, but only one-fourth included computer-related topics.

Bitter, Gary G. Calculus and the Computer: An Evaluation by Participants. Two Year College Mathematics Journal 1: 41-49; Fall 1970. ERIC: EJ 030 104.

A majority of the students involved in a five-college computer-extended calculus project found computer assignments on learning to program BASIC, the limit concept, and the derivative helpful. Generally, the course was considered more interesting with the computer than without it.

Clover, Michael E. Study of the Feasibility of Computer Assisted Pupil Progress Reporting in 4th Grade Mathematics. (The University of Iowa, 1972.) Dissertation Abstracts International 33A: 1312-1313; October 1972.

Behavioral objectives were developed and procedures devised to transfer records of these from optical scanner answer forms to pupil progress reports. Data on use of this system are reported. Teachers tended either to use it consistently or only once or twice; they either reported on all students an equal number of times or on a select few.

Committee on the Undergraduate Program in Mathematics. Recommendations for an Undergraduate Program in Computational Mathematics. Berkeley, California: CUPM, May 1971. ERIC: ED 062 158. 49 p. MF and HC available.

This report describes an undergraduate program designed to produce mathematicians who will know how to use and to apply computers.

Conference Board of the Mathematical Science. Recommendations Regarding Computers in High School Education. Washington: CBMS, April 1972. ERIC: ED 064 136. 36 p. MF and HC available.

Specific recommendations for the inclusion of computer-use in the secondary schools are made.

Connecticut State Department of Education. Computer Assisted Mathematics Instruction, Pilot Project. Hartford: State Department of Education, 1966. ERIC: ED 018 364. 35 p. MF and HC available.

How mathematics can be taught more effectively with computers, how computers must be programmed, how teachers can be trained, and the effects on the mathematics curriculum were explored in this project using a time-sharing system.

Cooley, William W. and Glaser, R. Computer Science for High School Students. School and Society 98: 6; January 1970.

A program for disadvantaged high school students using computers in mathematics and science instruction is described.

Danver, Jean. The Computer as a Study Tool. NASSP Bulletin 54: 18-26; February 1970. ERIC: EJ 015 728.

Uses of computers in the high school classroom are described, using languages such as BASIC for rapid calculations. Economic feasibility and advantages for all students are discussed.

Dixon, C. and Thurlbeck, L. W. Applications of a School Computer. Mathematics Teaching 54: 33-36; April 1971. ERIC: EJ 040 535.

Several uses of randomness and computer simulation in games of chance and genetics are discussed.

Duren, William L., Jr. Recommendations on the Undergraduate Mathematics Program for Work in Computing. Washington: Committee on the Undergraduate Program in Mathematics, Mathematics Association of America, 1964. ERIC: ED 022 699. 33 p. MF and HC available.

A program on preparation for work in computer science is proposed; general mathematics courses for the prospective computer specialist are cited.

Forsythe, Allan L. and Stansbury, Daviette B. Bobby and a Computer. Arithmetic Teacher 18: 88-90; February 1971. ERIC: EJ 033 642. (See also ERIC: EJ 036 641).

The conclusion that computer programming is applicable in the elementary school is supported by a case-study of one third-grade student's experiences with the computer.

Goldberg, Adele. A Generalized Instructional System for Elementary Mathematical Logic. Stanford: Institute for Mathematical Studies in the Social Sciences, Stanford University, October 1971. ERIC: ED 055 457. 96 p. MF and HC available.

A computer-based instructional system for teaching the notion of mathematical proof is described. The program, how to use it for research and teaching, block diagrams of key program routines, and example curriculums are included.

Goldberg, Adele and Suppes, Patrick. A Computer-Assisted Instruction Program for Exercises on Finding Axioms. Stanford: Institute for Mathematical Studies in the Social Sciences, Stanford University, June 1972.

A program to aid students in developing proofs is described and student reactions indicated.

Gumm, Robert Duane. An Analysis and Development of a Computer Science Program for Use in Secondary School Mathematics. (Oklahoma State University, 1969.) Dissertation Abstracts International 31A: 3899; February 1971.

Ways of using computers for instruction were studied, and a course of study recommended.

Harvey, R. B. Grade Seven and a Computer. School Science and Mathematics 68: 91-94; February 1968.

The class programmed several simple problems after receiving instruction on loops, test and branch strategies, and other simple computer programming steps.

Hatfield, Larry L. Computers in Mathematics Instruction. In Reviews of Recent Research in Mathematics Education, SMSG Studies in Mathematics, Vol. 19. (James W. Wilson and L. Ray Carry, Editors). Stanford University, 1969. pp. 129-152.

A summary of the literature about computer education is presented, which includes relatively little research on mathematics education.

Heimer, Ralph T. (Editor). Computer-Assisted Instruction and the Teaching of Mathematics. Washington: National Council of Teachers of Mathematics, 1969.

This is a report on a conference at The Pennsylvania State University, at which the present status and future prospects of CAI and its implications for the teaching of mathematics were discussed, including both machine and program development.

Hickey, Albert E. The Use of the Computer in Mathematics Instruction. Two Year College Mathematics Journal 1: 44-54; Spring 1970. ERIC: EJ 021 649.

The pedagogical question of what can be done with the computer that is relevant to the mathematics curriculum is reported. Five modes of interaction between computer and students are proposed: problem solving, programmed desk calculator, simulation, drill and practice, and tutorial.

Hoffman, Walter; Albrecht, Robert L.; Atchison, William F.; Charp, Sylvia; and Forsythe, Alexandra. Computers for School Mathematics. Mathematics Teacher 58: 393-401; May 1965.

Types and uses of digital computers in secondary schools, specific topics for use in mathematics classes, teacher training, and potential scope of secondary school computer activity are presented.

Horn, Lister W. and Gleason, Gary M. Teaching a Unit on the Computer to Academically Talented Elementary School Children. Arithmetic Teacher 17: 216-218; March 1970. ERIC: EJ 017 560.

This is a report on an experimental project to teach computer concepts to academically talented fifth and sixth graders. The unit covered the history of computers, numeration systems, computer hardware, and simple FORTRAN programming.

Jerman, Max. Promising Developments in Computer Assisted Instruction. Educational Technology 9: 10-18; August 1969. ERIC: EJ 008 095.

Developments in CAI at Stanford regarding drill-and-practice via "strands" - a type of branching - are discussed in general terms. Tutorial programs, time-sharing, simulation and gaming, inquiry systems, and hardware developments are briefly described.

Jerman, Max. The Use of Computers to Individualize Instruction. Mathematics Teacher 65: 395, 466-471; May 1972. ERIC: EJ 060 613.

Some current uses of computer for individualizing instruction are presented.

Lamon, William. The Computer: An Instructional Aid in the Secondary Mathematics Classroom. Journal of Educational Data Processing 8: 11-21; 1971. ERIC: EJ 054 715.

General descriptions of CAI and computer programming and some uses of the computer as an enrichment tool in mathematics and science are presented.

Land, F. W. Technological Aids in the Teaching of Mathematics. International Journal of Mathematical Education in Science and Technology 2: 41-49; January/March 1971. ERIC: EJ 038 131.

A rationale for supplementing the teaching of mathematics through the use of educational technology is presented. Ways of developing technological aids and examples of possible projects are included.

Lee, Kwi-Yoon. A Study and Analysis of the Effectiveness of Computer Assisted Reporting of Fifth Grade Pupils' Mathematical Progress as Perceived by Parents and Pupils. (The University of Iowa, 1972.) Dissertation Abstracts International 33A: 1368; October 1972.

The computer was used to produce report sheets containing statements which the teachers selected by code. Parents and pupils had favorable reactions to the reporting system.

Lerner, Seymour. The Computer as an Aid in Teaching Mathematics: An Instructional Bulletin, Grades 7-10. Los Angeles: Los Angeles City Schools, 1967. ERIC: ED 020 660. 107 p. MF and HC available.

This bulletin describes the possible uses of computers in the mathematics classroom. The operational procedures of computer use and the basic ideas of flow charing are explained.

Lopez, Guillermo. Algebra and Physics Taught by Teletype. California Teachers Association Journal 64: 10-12; March 1968.

Use of the computer as a tool for computation, learning concepts, and problem solving is described for Algebra II and Physics courses.

Love, William Pegram. Individual Versus Paired Learning of an Abstract Algebra Presented by Computer Assisted Instruction. (The Florida State University, 1969.) Dissertation Abstracts International 31A: 248; July 1970. ERIC: ED 034 403. 215 p. MF and HC available.

No significant differences were found between students who used a CAI program alone or in pairs.

Martin, Donna L. An Elective in Mathematics. Mathematics Teacher 60: 866-869; December 1967.

A one-semester course in junior high is proposed; content included study of the abacus, the slide rule, and computer programming using FORTRAN with flow charts.

McClain, Donald Henry. Development of a Computer-Assisted Instruction Unit in Probability. (Iowa State University, 1970.) Dissertation Abstracts International 31B: 5310: March 1971.

A CAI program on probability for statistics students was described.

Miles, E. P. Calculus and the Computer: The CRICISAM Project - Past, Present, and Portent. American Mathematical Monthly 78: 284-290; March 1971.

The development of an NSF-funded computer-oriented calculus text and supplementary materials is described in detail.

Morgan, Richard Thomas. The Role of the Digital Computer in a General Education Course in Mathematics. (Columbia University, 1968.) Dissertation Abstracts International 30A: 71-72; July 1969.

The mathematical competence of general education students appears to be enhanced when the content is integrated with computer science applications.

National Council of Teachers of Mathematics. Computer Facilities for Mathematics Instruction. Washington: The Council, 1967.

Instructional uses of computers, steps in problem solving, computer systems, and sample problems are presented. Cost analysis revealed that time-sharing systems are the least expensive and most efficient way to use computers as instructional tools in teaching mathematics.

Oldehoeft, Arthur E. Computer-Assisted Instruction in Teaching Numerical Methods. Final Report. Lafayette, Indiana: Purdue University Department of Computer Science, March 1970. ERIC: ED 039 778. 282 p. MF and PC available.

A program which assists the student in learning elementary algorithms of an undergraduate numerical methods course is described in detail, including special programming features and evaluation results.

Oliver, Alfred. A Measurement of the Effectiveness of an Interactive Display System in Teaching Numerical Analysis. (University of North Calolina at Chapel Hill, 1969.) Dissertation Abstracts International 30B: 4263-4264; March 1970.

Students who used an interactive graphics program achieved significantly more than a group not using the computer.

Post, Dudley L. (Editor). The Use of Computers in Secondary School Mathematics. Newburyport, Massachusetts: ENTELEK, 1970. ERIC: ED 046 236. Not available from EDRS.

Among the topics included are acquiring a computer capability, choosing a computer language, installing a time-sharing system, administering the computer terminal, using the computer in the mathematics classroom, and a summary of results from 18 schools using the time-sharing computer at Dartmouth.

Pride, Bonnie Loraine. A Critical Analysis of Computer Utilization by Mathematics Departments in Selected Small Colleges. (George Peabody College for Teachers, 1972.) Dissertation Abstracts International 33B: 1674-1675; October 1972.

In 82% of the colleges surveyed, the computer was used in one or more mathematics courses; 73% of the institutions gave students direct access to the computer.

Rahmlow, Harold F. and Kerr, Eugene G. The Modular Development of Computer-Assisted Instruction Programs. NSPI Journal 8: 20-23; February 1969.

A type of branching CAI program providing the student with objectives, content options, and diagnostic tests is described as used in elementary school mathematics classes.

Raucher, Stephen. Automation and the Senior High School. High Points 48: 73-75; May 1966.

This is a description of the introduction of computer mathematics in one high school, from its early beginnings as an informal group of interested students to its status as a fully accredited computer course of two classes and a laboratory.

Rockhill, Theron D. The Development of an Individualized Instructional Program in Beginning College Mathematics Utilizing Computer Based Resource Units. Brockport: State University of New York, Brockport, 1971. ERIC: ED 053 966. 79 p. MF and HC available.

Four computer-based resource units were developed on set theory, relations and function, algebra, trigonometry, and analytic geometry. Objectives, multiple-choice questions, programmed materials, and diagnostic computer programs were included. No significant differences in achievement were found when this program was compared with a non-computer-use method.

Rosenbaum, Sema Joy Marks. A Course in Computer Simulation for High School Students. (Harvard University, 1970.) Dissertation Abstracts International 31A: 5676; May 1971.

The course was developed for college-bound seniors with an interest and aptitude in mathematics.

Rudolph, Eleanore L. A Survey of Data Processing and Computer Use in Instruction in Illinois Secondary Schools. (Northern Illinois University, 1972.) Dissertation Abstracts International 33A: 505-506; August 1972.

One-third of the 647 schools surveyed used computers; 54% of these used computers for both instruction and administration. Use for problem-solving in mathematics and science and for teaching data processing accounted for over 80% of computer use in instruction.

Slagle, Robert D. Computer-Assisted Learning Taught in Project LOCAL. Science Teacher 36: 60-61; January 1969. ERIC: EJ 001 039.

Project LOCAL, a program to demonstrate and evaluate the use of the computer in secondary school mathematics and science instruction and to train teachers in computer usage, is briefly described.

Spencer, Donald D. Game Playing with Computers. New York: Spartan Books, 1968.

Descriptions of games, such an Nim, tic-tac-toe, magic squares, roulette, blackjack, etc., and how they may be programmed for play on a computer are given, with sample programs in BASIC and FORTRAN.

Suydam, Marilyn N. Teachers, Pupils, and Computer-Assisted Instruction. Arithmetic Teacher 16: 173-176; March 1969. ERIC: EJ 002 720.

Five types of CAI are defined: tutorial, drill and practice, inquiry, calculator, and management. A list of elementary school mathematics programs for CAI is presented.

Suydam, Marilyn N. Continuing the Math Revolution. American Education 6: 26-30; January-February 1970. ERIC: EJ 014 363.

Excerpts from five interviews with directors of mathematics curriculum development projects are presented, including one with Patrick Suppes of Stanford referring to the CAI work he has done.

Twaites, Bryan. The Role of the Computer in School Mathematics. Educational Studies in Mathematics 2: 346-359; December 1969. ERIC: EJ 033 865.

A general discussion on using the computer to solve theoretical and applied mathematics problems is given. Examples from calculus are provided.

Travers, Kenneth J. Mathematics Education and the Computer Revolution. School Science and Mathematics 71: 24-34; January 1971. ERIC: EJ 039 727.

Various uses of computers are discussed in terms of their impact on learning and curriculum. Some computer activities for a junior high mathematics class are suggested.

Underkoffler, Milton Monroe. Computer Assisted Instruction in College General Education Mathematics. (Iowa State University, 1969.) Dissertation Abstracts International 30A: 4700; May 1970.

The classes in which the computer was used to score and provide immediate feedback on weekly exercises scored significantly higher than classes in which scoring time took a week.

Werner, Sister Marijane. Computer-Assisted Planning and Scheduling of Individualized Programs of Study in Science and Mathematics at the Secondary Level. Journal of Educational Research 64: 127-132; November 1970. ERIC: EJ 028 462.

Use of the computer program for PERT, a form of critical path analysis, was found to aid in the ordering of interrelated units of study in mathematics.

West, Anita S. Wolfe. Development of a Computer-Administered Diagnostic College Placement Test in Mathematics. (University of Denver, 1969.) Dissertation Abstracts International 30B: 5154-5155; May 1970.

The computer-administered test was found to have a correlation of .59 with SAT math scores and GPA. Diagnosis, instant scoring and reporting of results, and ease of administration and of revision were cited as advantages.

Wolff, Robert Francis. A Feasibility Study on the Construction of a Diagnostic Test on Proper Fractions to be Administered, Scored and

Interpreted by a Computer. (Lehigh University, 1968.) Dissertation Abstracts International 29A: 3787-3788; May 1969.

A test administered via a teletypewriter effectively diagnosed students' errors.

Young, James Heyward, Jr. The Use of A Computer-Based Resource Guide to Pre-Plan a Unit of Instruction and to Develop Student Attitudes Toward Mathematics. (State University of New York at Buffalo, 1970.) Dissertation Abstracts International 31A: 1700; October 1970.

Teachers who requested materials after preplanning were rated higher on instructional units than those who asked for a "dump".

Zoet, Charles J. Computer Orientation in Livonia High Schools. School Science and Mathematics 66: 274-276; March 1966.

The introduction of computer science concepts and processes into regular mathematics courses is described.

Zoet, Charles J. Computers in Mathematics Education. Mathematics Teacher 62: 563-567; November 1969. ERIC: EJ 011 048.

Some key questions facing secondary schools as they consider the use of computers in their mathematics program are discussed, with some specific suggestions for levels at which a computer might be used.

---. Computing Concepts in Mathematics, Parts I and II. Chicago: Science Research Associates, Inc., 1968.

A history of computers and several computational algorithms and mathematics topics are presented.

No significant differences in achievement were found whether pupils (grades 4-8) or computer selected the problem type, with varied types of feedback.

Brod, Rodney Lynn. The Computer as an Authority Figure: Some Effects of CAI on Student Perception of Teacher Authority. (Stanford University, 1972.) Dissertation Abstracts International 33A: 139; July 1972.

Students were found to form authority relationships for goal attainment with the computer (when using a drill-and-practice program as remedial instruction in mathematics), thus reducing students' perception of the teacher's task-specific authority.

Butler, Cornelius F. CAI in New York City: Report on the First Year's Operations. Educational Technology 9: 84-87; October 1969. ERIC: EJ 012 289.

This is a report on the nation's largest CAI operation in a public school system. Results indicate definite success based on three criteria: (1) acceptance of CAI by schools and pupils, (2) cost per pupil, and (3) student achievement.

Carruth, Edwin Ronald. A Multiple Linear Regression Analysis of Computer-Assisted Elementary Arithmetic Achievement. (University of Southern Mississippi, 1970.) Dissertation Abstracts International 31A: 5691; May 1971.

Previous level of arithmetic achievement, intelligence, and reading ability had the greatest effect on success in the CAI drill-and-practice program.

Cole, William L. The Evaluation of a One-Semester Senior High School Mathematics Course Designed for Acquiring Basic Mathematical Skills Using Computer-Assisted Instruction. (Wayne State University, 1971.) Dissertation Abstracts International 32A: 2399; November 1971.

C. Tutorial and Practice Modes

Abramson, Theodore and Weiner, Max. Evaluation of the New York City Computer Assisted Instruction Program in Elementary Arithmetic, Second Year, 1969-70. February 1971. ERIC: ED 047 962. 11 p. MF and HC available.

It was reported that (1) pupils were exposed to about one-third the number of drill-and-practice lessons originally intended, (2) the program did not appropriately compensate for individual differences, (3) achievement test results showed no consistent pattern favoring CAI or non-CAI groups, (4) the amount of drill-and-practice in CAI and non-CAI classes was not observably different, and (5) attitudes toward the program of students, teachers, administrators, and parents were favorable.

Atkinson, Richard C. and Patrick Suppes. An Automated Primary-Grade Reading and Arithmetic Curriculum for Culturally-Deprived Children. Final Report. Stanford: Stanford University, 1968. ERIC: ED 023 773. 211 p. MF and HC available.

Developing and implementing a CAI program in mathematics and initial reading to individualize instruction was the focus of this project. Problems and introductory methods are described.

Atkinson, Richard C and Suppes, Patrick. Program in Computer-Assisted Instruction. Final Report. Stanford: Stanford University, August 1968. ERIC: ED 026 873. 95 p. MF and HC available.

Mathematics and reading programs following a tutorial model are described and results of use are reported.

Barnes, Ospy Dennis. The Effect of Learner Controlled Computer Assisted Instruction on Performance in Multiplication Skills. (University of Southern California, 1970.) Dissertation Abstracts International 31A: 4538; March 1971.

No significant differences in achievement were found whether pupils (grades 4-8) or computer selected the problem type, with varied types of feedback.

Brod, Rodney Lynn. The Computer as an Authority Figure: Some Effects of CAI on Student Perception of Teacher Authority. (Stanford University, 1972.) Dissertation Abstracts International 33A: 139; July 1972.

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Cole, William L. The Evaluation of a One-Semester Senior High School Mathematics Course Designed for Acquiring Basic Mathematical Skills Using Computer-Assisted Instruction. (Wayne State University, 1971.) Dissertation Abstracts International 32A: 2399; November 1971.

CAI was effective in improving computational skills in whole numbers, fractions, decimals, and percent for ninth graders.

Confer, Ronald William. The Effect of One Style of Computer Assisted Instruction on the Achievement of Students Who Are Repeating General Mathematics. (University of Pittsburgh, 1971.) Dissertation Abstracts International 32A: 1741; October 1971.

No significant difference on standardized tests was found for students taught by CAI or conventional instruction. The groups each scored higher on certain content areas.

Crawford, Alan N. A Pilot Study of Computer-Assisted Drill and Practice in Seventh Grade Remedial Mathematics. California Journal of Educational Research 21: 170-181; September 1970. ERIC: EJ 027 030.

Pupils who had 3-15 minutes of extra computational practice per day gained significantly from pre-to post-test; however, scores were not significantly different from those of a group with no extra practice.

Davies, Thomas Peter. An Evaluation of Computer-Assisted Instruction Using a Drill-And-Practice Program in Mathematics. (United States International University, 1972.) Dissertation Abstracts International 32B: 6970; June 1972.

Students using the computer program achieved significantly better on measures of computational skills than those not using the program.

Dean, Peter M. Learner Versus Teacher Controlled Arithmetic Practice. San Jose, California: IBM Corporation, February 1971. ERIC: ED 047 956. Not available from EDRS.

This study was designed to investigate the effect of allowing students (in grades 4-6) to generate their own addition, subtraction, and multiplication problems and make their own decisions concerning their rate of progress. Students under learner-controlled conditions learned more than students under teacher control.

Dennis, John Richard. Teaching Selected Geometry Topics Via A Computer System. (University of Illinois, 1968.) Dissertation Abstracts International 29A: 2145; January 1969.

Students were able to "acquire knowledge" about properties of triangles and quadrilaterals from a CAI program which allowed students to draw and verify figures.

Dick, Walter and Latta, Raymond. Comparative Effects of Ability and Presentation Mode in Computer-Assisted Instruction and Programed Instruction. AV Communication Review 18: 33-45; Spring 1970. ERIC: EJ 017 525.

Programmed instruction was compared with CAI for a unit on the concept of significant figures with eighth graders. The overall performance of students using programmed instruction was significantly better than that of students using CAI. The difference was attributable to the poor performance of low ability students using CAI.

Fejfar, James L. A Teaching Program for Experimentation with Computer-Assisted Instruction. Arithmetic Teacher 16: 184-188; March 1969. ERIC: EJ 003 031.

A program which will convert a small general-purpose computer to an electronic teaching machine capable of teaching skills with facts of multiplication and addition is presented.

Fejfar, James L. ISU Lab School Fourth Graders Learn Through CAI. Contemporary Education 40: 296-297; April 1969.

Pupils who used a computer-aided instruction program for practice on multiplication facts gained significantly more than pupils who had only regular classroom instruction in grade 4.

Feurzeig, Wallace. An Introductory LOGO Teaching Sequence: LOGO Teaching Sequence on Logic, LOGO Reference Manual. Cambridge, Massachusetts: Bolt, Beranek and Newman, Inc., 1971. ERIC: ED 057 579. 135 p. MF and HC available.

This is a report on the first effort to systematically develop extensive curriculum materials using the LOGO language; teaching sequences on geometry and logic are presented.

Grant, Richards et al. LOGO Teaching Sequence on Numbers and Functions and Equations (Teacher's Text and Problems). Cambridge, Massachusetts: Bolt, Beranek and Newman, Inc., 1971. ERIC: ED 057 580. 230 p. MF and HC available.

The application of LOGO to teaching sequences on numbers and functions is presented; the material on numbers is extremely detailed.

Jerman, Max. Some Strategies for Solving Simple Multiplication Combinations. Journal for Research in Mathematics Education 1: 95-128, March 1970. ERIC: EJ 038 736. MF and HC available.

Process models were tested with data from children using CAI. They appear to use different strategies for different combinations, and the strategy used may be a function of the combination itself. Strategies used in grade 3 appear to be the ones for the same combinations in grade 6 in 72 per cent of the cases.

Jerman, Max and Suppes, Patrick. A Workshop on Computer-Assisted Instruction in Elementary Mathematics. Arithmetic Teacher 16: 193-197; March 1969. ERIC: EJ 003 032.

A description of an in-service project in Mississippi is given, with a brief description of the Stanford drill-and-practice program.

Keene, Jenness. Brentwood Revisited: CAI's Two-Year Trial. Nation's Schools 80: 57-61; October 1968.

The results of the use of the Stanford program for a two-year period are cited.

Klotz, Guenter R. Drill-and-Practice Systems. Journal of Educational Data Processing 6: 307-317; December 1969. ERIC: EJ 017 059.

Several taxonomic schemes for classifying types of computer applications in instruction are reviewed, classifications which may be called CAI are identified, and drill-and-practice modes are discussed in detail within the perspective provided by these classifications.

Kratochvil, Daniel W. Arithmetic Proficiency Training Program Developed by Science Research Associates, Inc. Palo Alto, California: American Institutes for Research in the Behavioral Sciences, January 1972. ERIC: ED 062 184. 50 p. MF and HC available.

This report summarizes the development of a commercially available program in computational skills which makes extensive use of computer capabilities. Languages used are APL and Coursewriter III.

Loftus, Elizabeth Jane Fishman. An Analysis of the Structural Variables that Determine Problem-Solving Difficulty on a Computer-Based Teletype. (Stanford University, 1970.) Dissertation Abstracts International 31A: 5853; May 1971. ERIC: ED 047 505. 105 p. MF and HC available.

Four variables were identified which significantly affected the difficulty of problems: number of operations, sequence of problems, complexity, and conversions. Verbal clues, order of operations, and number of steps had little effect on difficulty.

Lukas, George et al. LOGO Teaching Sequence on Strategy in Problem-Solving and Story Problems in Algebra (Teacher's Text and Problems). Cambridge, Massachusetts: Bolt, Beranek and Newman, Inc., 1971. ERIC: ED 057 581. 226 p. MF and HC available.

Specific problem contexts are used to give definition and articulation to central notions like problem, problem form, solution method, and optimal strategy. Strategy formation on extrapolating number sequences and exploring mazes are illustrated. The focus on story problems in algebra is on converting into formal mathematical terms.

Miller, R·h and Hess, Robert D. The Effect Upon Students' Motivation of Fit Between Student Ability and the Level of Difficulty of CAI Programs. Stanford: Center for Research and Development in Teaching, Stanford University, March 1972. ERIC: ED 062 831. 43 p. MF and HC available.

The engaging characteristics of CAI that were identified were: its curiosity-provoking aspects, its immediate feedback, its provision of a form of competence-testing for the student, and its presentation of lessons matched to the student's level of competence. Engagement was highest on easy lessons and did not begin to drop until pupils missed more than 20% of the problems on the drill-and-practice lesson.

Mitzel, Harold E. et al. A Commonwealth Consortium to Develop, Implement and Evaluate a Pilot Program of Computer-Assisted Instruction for Urban High Schools. Final Report. University Park, Pennsylvania: The Pennsylvania State University, Computer Assisted Instruction Laboratory, July 1971. ERIC: ED 059 604. 213 p. MF and HC available.

This is a report on a project with the School Districts of Philadelphia and Pittsburgh to develop tutorial CAI programs for general mathematics and algebra. Course development, summative evaluation, and a cost analysis are presented along with summaries of the courses and the materials used with them off-line.

Moloney, James Michael. An Investigation of College Student Performance of a Logic Curriculum in a Computer-Assisted Instruction Setting. Stanford University, 1972.) Dissertation Abstracts International 32A: 6851; June 1972. Also, Stanford: Institute for Mathematical Studies in the Social Sciences, Stanford University, January 1972. ERIC: ED 062 780. 99 p. MF and HC available.

Responses for 203 logic problems were analyzed; seven structural variables were found to be significant in predicting problem difficulty (but they accounted for only one-third of the variance).

Ostheller, Karl Olney. The Feasibility of Using Computer-Assisted Instruction to Teach Mathematics in the Senior High School. (Washington State University, 1970.) Dissertation Abstracts International 31A: 4042; February 1971.

A significant difference in achievement favored the group taught a unit on probability and statistics with CAI. Attitudes were not different, but students preferred teacher-pupil interaction.

Papert, Seymour. Teaching Children Thinking. Mathematics Teaching 58: 2-7; Spring 1972. ERIC: EJ 056 228.

Computer programs can be written by children to instruct each other.

Prince, J. D. A Practitioner's Report - Results of Two Years of Computer Assisted Instruction in Drill-and-Practice Mathematics (1967-1969). McComb, Mississippi: McComb Municipal Separate School District, 1969. ERIC ED 032 769. 38 p. MF and HC available.

Use of the Stanford drill-and-practice program is described. The school administration felt CAI was viable, but problems of cost, lack of sufficient programs, plurality of language, and inappropriateness of computer design for educational purposes raise doubts as to its widespread implementation.

Riedesel, C. Alan and Suydam, Marilyn N. Computer-Assisted Instruction: Implications for Teacher Education. Arithmetic Teacher 14: 24-29; January 1967.

The feasibility of using CAI in mathematics courses for elementary school teachers was discussed. No significant differences were found between two small groups of pre-service teachers given instruction on mathematics content by a teacher or via CAI.

Rothbart, Andrea and Steinberg, Esther. Some Observations of Children's Reactions to Computer-Assisted Instruction. Arithmetic Teacher 18: 19-21; January 1971. ERIC: EJ 032 201.

A variety of reactions of children in grades K-6 to a PLATO installation are related.

Smith, Ian D. and Hess, Robert D. The Effects of Computer-Assisted Instruction on Student Self-Concept, Locus of Control, and Level of Aspiration. Stanford: Center for Research and Development in Teaching, Stanford University, May 1972. ERIC: ED 062 832. 25 p. MF and HC available.

The CAI drill-and-practice program promoted realistic attitudes toward mathematics; it did not prove dehumanizing and no across-the-board negative attitudes resulted.

Stovall, Gayden. Long Distance Learning. Audiovisual Instruction 14: 20-23; February 1969. ERIC: EJ 000 995.

The McComb, Mississippi CAI mathematics project is described.

Suppes, Patrick. The Uses of Computers in Education. Scientific American 215: 206-220; September 1966. ERIC: ED 027 549. Not available from EDRS.

Experiments in computer-assisted instruction are described, with a discussion of why CAI is desirable, type of equipment, types of CAI, and types of responses.

Suppes, Patrick and Ihrke, Constance. Accelerated Program in Elementary-School Mathematics - The Third Year. Psychology in the Schools 4: 293-309; September 1967.

Materials being used in a Stanford CAI program were described, and results were presented and discussed.

Suppes, Patrick and Ihrke, Constance. Accelerated Program in Elementary-School Mathematics - The Fourth Year. Psychology in the Schools 7: 111-126; June 1970. See also ERIC: ED 036 426. 42 p.

Program information and data for pupils using texts on sets, numbers, and probability, and CAI programs on drill, logic, and algebra during 1966-67 were presented and discussed.

Suppes, Patrick and Morningstar, Mona. Computer-Assisted Instruction: The 1966-67 Starford Arithmetic Program. New York: Academic Press, 1969.

This is one of several reports on the Stanford CAI Project. Information on more recent development is available in another book from the same publishers, as well as in articles and other reports.

Suppes, Patrick and Morningstar, Mona. Evaluation of Three Computer-Assisted Instruction Programs. Stanford: Institute for Mathematical Studies in Social Sciences, Stanford University, 1969. ERIC: ED 031 408. 62 p. MF and HC available.

Research in schools in California and Mississippi is summarized; the Stanford drill-and-practice program and the tutorial program were used.

Suppes, Patrick and Morningstar, Mona. Computer Assisted Instruction. Science 166: 343-350; October 1969. ERIC: EJ 000 973.

CAI programs in mathematics were evaluated; the conclusion was reached that problems of lack of teaching training and of time can be overcome by the computer, which can also offer valuable student enrichment programs.

Suppes, Patrick and Searle, Barbara. The Computer Teaches Arithmetic. School Review 79: 213-225; February 1971. ERIC: EJ 033 545.

Block and strand CAI drill-and-practice programs in elementary school mathematics are described.

Suppes, Patrick; Jerman, Max; and Brian, Dow. Computer-Assisted Instruction: Stanford's 1965-66 Arithmetic Program. New York: Academic Press, 1968. ERIC: ED 034 432. Not available from EDRS.

Details of the arithmetic drill-and-practice program are described. There is also an overview of CAI at Stanford since 1963.

Suppes, Patrick; Jerman, Max; and Groen, Guy. Arithmetic Drills and Review on a Computer-Based Teletype. Arithmetic Teacher 13: 303-309; April 1966. See also ERIC: ED 014 215. 17 p. MF and HC available.

A description of a program to review and teach basic number facts as a supplement to the teacher's daily instruction in grade 4 is given. Difficulty level was found to be related to the type and form of problems. Time to completion and number of errors were found to be positively related.

Suppes, Patrick; Loftus, Elizabeth F.; and Jerman, Max. Problem Solving on a Computer-Based Teletype. Stanford: Instutute for Mathematical Studies in the Social Sciences, Stanford University, March 1969. ERIC: ED 029 795. 26 p. MF and HC available. See also ERIC: EJ 011 139.

Research related to the use of the drill-and-practice materials in elementary schools is reported. The sequential variable was identified (from six factors considered) as the most important in determining problem difficulty.

Damaskos, Nickander J. A Case Study in Mathematics - The Cone Problem. Mathematics Teacher 62: 642-649; December 1969. ERIC: EJ 013 576.

Using the computer to compare the solution of finding the volume of a right-truncated cone given the altitude and half angle is described. Various techniques used in solving the problem are shown, with a flow chart and program in BASIC.

Danver, Jean H. Dartmouth Project COEXIST (Computer Oriented Experiment in Science Teaching): A Discussion of the First Year's Activities 1969-70. Hanover, New Hampshire: Dartmouth College, 1970. ERIC: ED 058 031. Not available from EDRS.

The main goal of COEXIST is to develop a new introductory sequence of calculus courses, accompanied by a physics sequence and an introductory engineering course, relying on the use of time-shared computer and automatic plotting equipment.

Dorn, William S. Computers in the High School. Datamation 13: 34-35; February 1967.

"Computer-extended-instruction" is described for use in high school mathematics courses. Several examples are given to show how FORTRAN programs can help students understand mathematical concepts.

Dorn, William S. and Edwards, Judith B. Finding the Best Solution Via Computer. Journal of Educational Data Processing 6: 90-107; Spring 1969. ERIC: EJ 005 533.

How the computer can be used in solving the problem of maximizing an area is presented.

Dorn, William S. Computer-Extended Instruction: An Example. Mathematics Teacher 63: 147-158; February 1970. ERIC: EJ 039 508.

D. Problem-Solving Mode

Altoona Area School District. Algebra I; Algebra II; Trigonometry; Physics (Teaching Guides). Bethesda, Maryland: General Electric Company, 1969.

Each book contains a number of annotated BASIC programs along with some exercises.

Berkeley, E. C. The Romance of Good Teaching and Time-Shared Computer. Computers and Automation 14: 12-17; September 1965.

The use of a remote console of a time-sharing computer for mathematics at the high school level is discussed.

Bitter, Gary. Computer-Oriented Calculus. Journal of Educational Data Processing 7: 193-195; March 1970. ERIC: EJ 027 020.

Students at Colorado College in a computer assisted mathematics course did better than students who were not aided by a computer.

Bitter, Gary Glen. Effect of Computer Applications on Achievement in a College Introductory Calculus Course. (University of Denver, 1970.) Dissertation Abstracts International 31B: 6109; April 1971. See also ERIC: ED 047 963. Not available from EDRS.

College students who used computer homework assignments achieved significantly higher than those who did not use the computer.

Braun, Ludwig and Visich, Marian. The Uses of Computers in High Schools (Huntington Project). Brooklyn: Polytechnic Institute of Brooklyn, 1969-1970. ERIC: ED 042 347. Not available from EDRS.

This is an eight-volume teaching guide covering many topics in mathematics, science, and social science, with programs included. "Huntington Two," an extension of this project, is continuing the development of computer-related materials.

Brown, Richard. Predicting the Outcome of the World Series. Mathematics Teacher 63: 494-500; October 1970. ERIC: EJ 027 055.

The use of student-written computer programs simulating the play of the 1969 World Series is described. The probabilities for National League wins were determined under varying circumstances.

Buchman, Aaron L. Patterns in Algorithms for Determining Whether Large Numbers Are Prime. Mathematics Teacher 63: 30-41; January 1970. ERIC: EJ 013 603.

The computer and number theory are used to develop successively more efficient algorithms for determining whether large numbers are prime. A program in BASIC is included.

Committee on the Undergraduate Program in Mathematics. Calculus with Computers. Berkeley, California: Mathematical Association of America, August 1969.

Uses of the computer in calculus courses are discussed.

Computing and Mathematics Curriculum Project (CMCP). Natural Bases for Logarithms; Complex Numbers; Limits; Functions. Denver: University of Denver, 1970.

The four computer-extended instruction units use BASIC; they are intended to supplement a textbook and assume availability of computer facilities.

Damaskos, Nickander J. A Case Study in Mathematics - The Cone Problem. Mathematics Teacher 62: 642-649; December 1969. ERIC: EJ 013 576.

Using the computer to compare the solution of finding the volume of a right-truncated cone given the altitude and half angle is described. Various techniques used in solving the problem are shown, with a flow chart and program in BASIC.

Danver, Jean H. Dartmouth Project COEXIST (Computer Oriented Experiment in Science Teaching): A Discussion of the First Year's Activities 1969-70. Hanover, New Hampshire: Dartmouth College, 1970. ERIC: ED 058 031. Not available from EDRS.

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Dorn, William S. and Edwards, Judith B. Finding the Best Solution Via Computer. Journal of Educational Data Processing 6: 90-107; Spring 1969. ERIC: EJ 005 533.

How the computer can be used in solving the problem of maximizing an area is presented.

Dorn, William S. Computer-Extended Instruction: An Example. Mathematics Teacher 63: 147-158; February 1970. ERIC: EJ 019 502.

The use of computer is conjunction with a traditional mathematics course is discussed. Some maximization and minimization problems using BASIC are presented.

Feng, Chuan C. Computer Related Mathematics and Science Curriculum Materials. Boulder, Colorado: Boulder Valley School District (with Jefferson County School District), 1967.

This collection of 22 teacher-written projects deals with the classroom application of computers. The projects were completed during an in-service summer program at the University of Colorado; the participants used BASIC on remote consoles connected to the GE time-sharing computer system in Phoenix.

Forsythe, Alexandra. Mathematics and Computing in High School: A Betrothal. Mathematics Teacher 57: 2-7; January 1964.

The use of the computer in an algorithmic approach to high school analytic geometry is discussed, with a program for exploring the geometric relations between the graphs of two linear equations.

Forsythe, George E. Solving a Quadratic Equation on a Computer. In The Mathematical Sciences: A Collection of Essays. Cambridge, Massachusetts: The M.I.T. Press, 1969. pp. 138-152.

After a brief review of major uses of the computer, the difference between theoretical computation (that of arithmetic and algebra) and practical computation (that actually carried out on a computer) is explored. The limitation of a computer system, with a finite, floating-point, is thus presented.

Graham, Ray Logan. An Investigation of the Effects of Computer upon Elementary Analysis. (New Mexico State University, 1968.) Dissertation Abstracts International 29B: 1431; October 1968.

Changes in calculus resulting from computer use were explored, with pedagogical, structural, and philosophical factors cited.

Gruenberger, Fred and Jaffray, George. Problems for Computer Solution. New York: John Wiley and Sons, Inc., 1965.

This is a source book for problems with a wide range of difficulty, mostly at the college level, which can best be solved with the aid of a computer. These are designed to aid in the teaching of problem solving and computer solution rather than mathematical concepts; FORTRAN is used.

Hatfield, Larry Lee. Computer-Assisted Mathematics: An Investigation of Effectiveness of the Computer used as a Tool to Learn Mathematics. (University of Minnesota, 1969.) Dissertation Abstracts International 30A: 4329-4330; April 1970. ERIC: ED 053 916. Not available from EDRS.

During the first years, significant differences were found between seventh grade groups who used computer-programming and those who did not on only one of 11 criterion tests. Learning of BASIC programming language seemed to interfere with concurrent study of numeration systems. During the second year, significant differences favoring the computer group were found on three of 12 tests, with high and average achievers especially favored. The number theory unit seemed particularly relevant for computer use.

Hatfield, Larry L. Computer-Extended Problem Solving and Enquiry. In The Use of Computers in Mathematics Education Resource Series, Publication No. V. Columbus, Ohio: ERIC/SMEAC, February 1973.

This is a review of some of the pedagogical rationales and recent research evidence related to the use of computers as instructional tools in mathematics classrooms, particularly as problem-solving tools.

Hatfield, Larry L. and Kieren, Thomas E. Computer-Assisted Problem Solving in School Mathematics. Journal for Research in Mathematics Education 3: 99-112; March 1972. ERIC: EJ 055 232.

Writing and using computer programs related to selected mathematical content appeared to positively affect performance on those topics.

Hemmerle, W. J. Statistical Computations on a Digital Computer. Waltham, Massachusetts: Blaisdell Publishing Co., 1967.

This is an advanced text that might be used as a teacher reference for particular topics appropriate to advanced students in secondary schools.

Hirsch, Joseph. Prime Triplets. Mathematics Teacher 62: 467-471; October 1969. ERIC: EJ 010 953.

A FORTRAN II program consisting of three basic parts is outlined; generating and storing all primes less than 1000, generating all prime triplets whose replacement set is that of the primes stored in the computer and whose least member exceeds 3, and testing the spacing of each triplet generated for divisibility by 6.

Hoffman, Irwin J. Effect of Computer Application on Generalization Skills and Achievement in a Second Year Algebra Course. (University of Denver, 1971.) Dissertation Abstracts International 32B: 2856-2857; November 1971.

No evidence was found that use of the computer significantly affected generalization skills or achievement, except for certain simple analysis skills.

Hoffman, Irwin and Xanvar, Larry. Polynomial Synthetic Division. Mathematics Teacher 63: 429-431; May 1970. ERIC: EJ 020 923.

A BASIC program for developing the algorithm for polynomial synthetic division is described; a flow chart and printout are included.

Hughes, Helen S. An Experimental Program in Computer-Assisted Mathematics. National Association of Secondary School Principals Bulletin 54: 85-90; February 1970. ERIC: EJ 015 946.

The use of the computer with BASIC in two eleventh grade classes in integrated algebra/trigonometry and with two twelfth grade classes in mathematical analysis is described.

Hughes, Helen S. Gauss, Computer-Assisted. Mathematics Teacher 64: 155-166; February 1971. ERIC: EJ 033 639.

The computer is used as an aid to teaching the idea of an existence theorem, Gauss's theorem for constructible regular polygons.

Hull, T. E. The Numerical Integration of Ordinary Differential Equations. Berkeley, California: Committee on the Undergraduate Program in Mathematics (CUPM), 1966.

This college level text emphasizes applications for the computer.

Hunt, Earl B. et al. Possible Applications of Computer Oriented Problem Solving Methods to Mathematics Education. Southwest Regional Education Laboratory, 1968. ERIC: ED 029 785. Not available from EDRS.

Simulation and its value to instruction, theorem proving techniques, and the analysis application of the FORTRAN deductive system are considered.

Indelicato, Brother Arthur. Evaluation of Polynomials Using a Computer. School Science and Mathematics 65: 768-769; December 1965.

A single general method, synthetic substitution, is described; it will evaluate any polynomial by giving the computer the coefficients and the value of x for the desired function of x.

Indelicato, Brother Arthur. Generating "Random" Numbers Using Modular Arithmetic. Mathematics Teacher 62: 385-391; May 1969. ERIC: EJ 005 018.

Procedures for using FORTRAN and modular arithmetic as a vehicle for generating random numbers are gien.

Johnson, David C. and Koetke, Walter J. Computers in the Mathematics Classroom: Selected Bibliography - Annotated. Washington: National Council of Teachers of Mathematics, May 1971.

This revision of a 1968 listing contains selected sources of classroom materials or suggestions for classroom use of the computer as a problem solving tool in mathematics, some references on computers in education and computer science, a listing of periodicals and articles, and a list of professional societies.

Johnson, David C.; Hatfield, Larry L.; Katzman, Pamela W.; Kieren, Thomas E.; LaFrenz, Dale E.; and Walther, John W. Computer Assisted Mathematics Program (CAMP). Glenview, Illinois: Scott Foresman and Company, 1968-1970.

This is a set of six supplementary student booklets for grades 7-12, containing many exercises. Students write computer programs in BASIC to study concepts and solve problems.

Katz, Saul M. A Comparison of the Effects of Two Computer Augmented Methods of Instruction with Traditional Methods upon Achievement of Algebra Two Students in a Comprehensive High School. (Temple University, 1971.) Dissertation Abstracts International 32A: 1188-1189; September 1971.

The more effective method of computer utilization appeared to be program-writing with no direct computer-access.

Kelsey, Kenneth W. Exercises in Computer-Assisted Physics and Mathematics. School Science and Mathematics 67: 119-123; February 1967.

Eighteen laboratory exercises integrating mathematics and physics are given, using new approaches to instruction aided by the computer.

Kemeny, John G. and Kurtz, Thomas E. The Dartmouth Time-Sharing Computer System. Final Report. Hanover, New Hampshire: Dartmouth College, June 1967.

This is one in a series of reports on the Dartmouth project. More recent reports may be obtained by writing to the project.

Kemeny, John G. and Kurtz, Thomas E. Dartmouth Time-Sharing. Science 162: 223-228; October 1968.

The Dartmouth time-sharing system from its beginning to 1968 is described.

Kerr, Eugene G. and Rahmlow, Harold F. Computer-Assisted Math Instruction in Small Schools. Audiovisual Instruction 14: 24-26; February 1969. ERIC: EJ 000 991.

A series of programmed booklets on "occupationally oriented basic mathematics" were developed for use with a time-sharing system, using FORTRAN.

Kieren, Thomas E. Quadratic Equations - Computer Style. Mathematics Teacher 62: 305-309; April 1969. ERIC: EJ 002 744.

One quadratic equation is solved with the development of more sophisticated programs (using BASIC) and analysis of data from internal approximation. It is suggested that students then attack the general problem of solving quadratic equations. Research results supporting the use of computers in this way are cited.

Kieren, Thomas Ervin. The Computer as a Teaching Aid for Eleventh Grade Mathematics: A Comparison Study. (University of Minnesota, 1968.) Dissertation Abstracts International 29A: 3526-3527; April 1969. ERIC: ED 053 909. Not available from EDRS.

Mean achievement of the group using computer programming for problem solving tended to be higher, especially for average students.

Kieren, Thomas E. Computer Programming for the Mathematics Laboratory. Mathematics Teacher 66: 9-11; January 1973.

How to plan for computer use in a laboratory situation is discussed, with a specific illustration of objectives and content.

Koetke, Walter J. Computers in the Classroom. Maynard, Massachusetts: Digital Equipment Corporation, 1968.

This reference contains specific suggestions on how and when to use the computer in a first-year algebra course.

Kovach, Ladis D. Computer-Oriented Mathematics: An Introduction to Numerical Methods. San Francisco: Holden-Day, 1964.

A number of interesting problems are given; the material is written to be used without a computer.

Krabill, David and Long, Clifford. A FORTRAN Program for Computer Plotting of Functions of Two Variables. Mathematics Teacher 65: 210-216; March 1972. ERIC: EJ 054 900.

The computer program and some sample printouts are presented and briefly discussed.

Kurtz, Thomas. Demonstration and Experimentation in Computer Training and Use in Secondary Schools. Hanover, New Hampshire: Dartmouth College, 1968. ERIC: ED 027 225. 81 p. MF and HC available.

A major goal of the project is to produce units in which the computer can be used to enhance the teaching or learning of mathematics, science, and other secondary school subjects. The regional computer system and how it has been used in the schools are described.

LaFrenz, Dale E. and Kieren, Thomas E. Computers for All Students: A New Philosophy of Computer Use. School Science and Mathematics 69: 39-41; January 1969. ERIC: EJ 001 048.

After discussion of various uses of computers, computer programming as a tool for teaching problem solving in mathematics is discussed. The CAMP materials and the philosophy of imbedding the computer-use in the mathematics curriculum are then described.

Maier, Bruce. Comparison Between Various Methods for Determinig Pi with Respect to Running Time in a Computer. School Science and Mathematics 72: 777-781; December 1972.

Four methods for reaching a pre-set value for Pi are presented, with a listing of each program.

McGuire, Bill. Mathematical Induction and a Programming Problem. Mathematics Teacher 66: 21-22; January 1973.

A FORTRAN program to order an arbitrary set of numbers in ascending sequence is discussed.

Montague, Margarlete Ann. Introducing Matrix Algebra with Computer Programming. Mathematics Teacher 64: 65-72; January 1971. ERIC: EJ 033 612.

A matrix algebra course for high school seniors using computer programming with FORTRAN IV is described.

McPherson, Ann and Cruikshank. Douglas Newton's Computer Program. School Science and Mathematics 69: 191-194: March 1969. ERIC: EJ 002 901.

This article puts the computer into a historical perspective, illustrating the extraction of square roots with a flow diagram and a seventeenth century algorithm.

National Council of Teachers of Mathematics. Computer Oriented Mathematics: An Introducation for Teachers. Washington, D.C.: The Council, 1963.

This somewhat-dated booklet contains a general description of computers and computer-assisted problem solving in mathematics.

Nevison, John M. Dartmouth College Secondary School Project (Mid-Year Report). Hanover, New Hampshire: Dartmouth College, 1968.

Many mathematics curriculum areas with potential for computer use are given in this report, as well as more detailed information on some selected mathematics problems.

Nevison, J. M. The Computer as Pupil: The Dartmouth Secondary School Project. Hanover, New Hamphsire: Dartmouth College, 1970.

This is one in a series of reports on the Dartmouth time-sharing project.

Pack, Elbert Chandler. The Effect of Mode of Computer Operation on Learning a Computer Language and on Problem Solving Efficiency of College Bound High School Students. (University of California, Los Angeles, 1970.) Dissertation Abstracts International 31A: 6477; June 1971.

No significant differences were found on the language test or in number of mathematics problems solved, but students preferred the time-sharing mode to quick-batch and slow-batch modes.

Pavlovich, J. P. Inductive Thinking Using the Computer. Mathematics Teacher 65: 329-332; April 1972. ERIC: EJ 057 972.

A computer program and output for a problem in calculus are presented.

Richardson, Jessie O. Teaching Mathematics Through the Use of a Time-Shared Computer. Final Report. Boston: Massachusetts State Department of Education, March 1968. ERIC: ED 023 606. 224 p. MF and HC available.

Reported is a project designed to use the computer as the basis for a laboratory approach to the presentation of mathematics. Classroom instruction was augmented by student experiments in devising and testing mathematical algorithms on the computer.

Ronan, Franklin Delano. Study of the Effectiveness of a Computer When Used as a Teaching and Learning Tool in High School Mathematics. (The University of Michigan, 1971.) Dissertation Abstracts International 32A: 1264-1265; September 1971.

Students who used a computer scored significantly higher on some (but not all) measures of achievement than those not using the computer.

Sage, Edwin R. Problem Solving with the Computer. Newburyport, Massachusetts: ENTELEK Inc., 1969. ERIC: ED 046 235. Not available from EDRS.

This introductory text on solving problems with BASIC includes many problems for use in secondary school mathematics classes.

Schery, Stephen D. Topics in Numerical Analysis for High School Mathematics. Mathematics Teacher 63: 313-317, April 1970. ERIC: EJ 018 795.

The use of the computer in an exploratory mathematics program in elementary numerical analysis is discussed. Examples are included on numerical

integration, matrices, linear equations, and various methods for finding roots of polynomials.

Schmidt, Harvey E. The Use of the Computer as a Unique Teaching Tool for Introductory Calculus. Final Report. Ferguson, Missouri: Florissant Valley Community College, June 1970. ERIC: ED 042 655. 37 p. MF and HC available.

An experiment designed to test the effectiveness of computer use by junior college students is reported. No significant difference in achievement was found between 15 students using the computer as a calculator and 15 students using pencil and paper.

School Mathematics Project. Computing in Mathematics: Some Experimental Ideas for Teachers. New York: Cambridge University Press, 1971.

This initial book in a new SMP computer series emphasizes the logical processes of computer algorithms for problems without assuming a particular language or machine application. Flow charts are followed by computer results. Basic computer concepts are developed and mathematical application explored.

School Mathematics Study Group. Algorithms, Computation, and Mathematics. Pasadena, California: A. C. Vroman, Inc., 1966.

This twelfth grade mathematics and computer course textbook extensively describes how the computer works and how to use the computer in studying mathematics. Supplements for FORTRAN and ALGOL are available.

Simone, Albert J. A FORTRAN Program for a Recursion Formula for Simultaneous Linear Equations. Mathematics Teacher 60: 452-458; May 1967.

A computer program with flow chart, sample data, and output for the formula for solving n simultaneous equations in n variables is given.

Smith, Robert E. Computer Explorer Series. Minneapolis: Control Data Corporation, 1970, 1971.

This series of paperbacks, on such topics as "Interest in Money", "Random Numbers", "Population Holocaust", "Excursion in Astrology", and "Your Handwriting", provide applications in computer programming. One idea is presented in each booklet and described in both BASIC and FORTRAN.

Smithson, Thomas W. An Eulerian Development for Pi: A Research Project for High School Students. Mathematics Teacher 63: 597-608; November 1970. ERIC: EJ 030 370.

The use of the computer to calculate the values of series as approximations to Pi is described. A computer program for computational verification output of two series which converge to Pi is included.

Stark, William. Calculus and the Computer - CRICISAM. Two Year College Mathematics Journal 2: 51-54; February 1971. ERIC: EJ 045 558.

This is a report on the development and use of a course on calculus.

Steinbach, Robert C. Programming Exercises for Problem-Oriented Languages. Beverly Hills, California: Glencoe Press, 1969.

A series of laboratory exercises is presented, with no specific programming language used.

Stenberg, Warren B. and Walker, Robert J. Calculus: A Computer Oriented Presentation. Tallahassee: Florida State University, Center for Research in College Instruction of Science and Mathematics (CRICISAM), 1968.

Calculus is introduced using algorithmic concepts; the development of concepts is independent of a specific programming language.

Swartz, Boyd G. Using a Small Computer in the College Mathematics Curriculum. Educational Technology 10: 31-32; March 1970. ERIC: EJ 020 271.

Use of the PDS 1020 computer in statistics and algebra is described. Measurement of effectiveness and recommendations for a continuing program are presented.

Teague, Robert. Computing Problems for FORTRAN Solution. San Francisco: Harper & Row, Canfield Press, 1972.

About fifty problems, with an explanation for each to motivate the solution, are included.

TeSelle, David W. Pi, Polygons, and a Computer. Mathematics Teacher 63: 128-132; February 1970. ERIC: EJ 035 176.

The approximation of Pi, applying Archimedes' method with computers, is detailed; the program and output in BASIC are included.

Travers, Kenneth J. and Knaupp, Jonathan E. The Computer Revolution Needs YOU! Arithmetic Teacher 18: 11-17; January 1971. ERIC: EJ 031 853.

An illustration is given of two classroom applications for the computer: calculating partial sums of convergent series and finding an approximate square root. A rationale for computer education in the mathematics classroom is also provided.

Wahl, M. Stoessel. Computer-Enriched Instruction for the Elementary Teacher. Atithmetic Teacher 16: 189-192; March 1969. ERIC: EJ 002 723.

Summing a geometric series and producing a table of perfect squares are suggested as two possible topics for an elementary teacher to present to his class to illustrate the use of computers.

Wallace, David Campbell. The Impact of Computer Mathematics on the Learning of High School Trigonometry and Physics. (The University of Texas at Austin, 1968.) Dissertation Abstracts International 29A: 3540; April 1969.

Students who had review of trigonometry using flow charting and elementary computer techniques gained significantly more than those who had trigonometry with or without a computer mathematics course first.

Warren, John C. Evaluating the Cosine Function. Mathematics Teacher 64: 557-561; October 1971. ERIC: EJ 044 838.

This article demonstrates an iterative method of evaluating the cosine function which can be derived using secondary school trigonometry. A sample computer run is included.

Washburn, Robert Miles. CEMP - A Computer Enriched Mathematics Program. (Cornell University, 1969.) Dissertation Abstracts International 30A: 5179; June 1970.

The writing, execution, and correction of computer programs (using CUPL) was found to strengthen understanding of mathematical concepts and result in a strong positive attitude at each of the grade levels studied (7, 8, 12, college freshmen). Although high-IQ students tended to derive greater benefit, average and low-IQ students also benefited.

Young, Gail. The Computer and the Calculus. Educational Studies in Mathematics 1: 105; May 1968.

Various uses of the computer in calculus instruction and changes introduced by computers are discussed. A revamping of the entire course content, rather than merely inserting certain topics from numerical analysis, is proposed.